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THE WHEAT-FLY.*

Although several facts in the habits and economy of the wheat-fly had occurred to my notice at sundry times since its appearance in this vicinity, yet as my leisure for studies of this nature was wholly engrossed in other departments of the science of entomology, these facts had been observed in too cursory a manner to be of material value in preparing an account for the public eye. It has not been until the present year, that I have made this and its allied species my particular study. And as some few interesting points still remain undetermined, ere a perfectly complete history of this insect can be given, I should be inclined still to defer preparing a paper upon this subject, but that I deem some of the observations already made of too much importance to be longer withheld, and am moreover very well aware that if no writer ventured to appear before the public until his investigations were so complete in every particular that he could *exhaust* the subject on which he wrote, very little would be published, and the world would have but a small fraction of that amount of information which it now possesses.

It is necessary for me further to premise, that although we have two distinct species of wheat-flies, as will be fully shown in the sequel of this paper, to wit, the *clear-winged wheat-fly* (Cecidomyia Tritici of *Kirby*) and the *spotted-winged wheat-fly*, which has hitherto remained a nondescript; yet as nothing is yet known of the habits and transformations of one of these as distinct from the other, through the body of this article the common name "wheat-fly" will be employed for convenience as referring to both these species. Future researches, however, may detect dissimilarities in their habits, and show that portions of the following account are true only with regard to one of these.

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* The following essay originally appeared in the American Quarterly Journal of Agriculture and Science, vol. ii, number 2; to the editors of which our acknowledgments are also due for the illustration with which it is accompanied. The essay has been revised, and new paragraphs added by the author.

Its Foreign History.

The first distinct and unequivocal account of the wheat-fly, of which I am aware, is that given by Mr. Christopher Gullet, in 1771, in a letter to Dr. Matty "On the effects of elder in preserving growing plants from the insects and flies," which letter was published in the Philosophical Transactions of the Royal Society the following year.*

* So long ago as the year 1768, Col. Langdon Carter, of Virginia, transmitted to the American Philosophical Society a paper entitled "Observations concerning the FLY-WEEVIL that destroys the wheat;" which was published in the first volume of the Society's Transactions, 2d edition, pages 274–287. The account here given, is in nearly all its particulars so strikingly applicable to the wheat-fly, that so much of it as relates to the insect itself merits an introduction in this place. He rather quaintly remarks, "In a pleasant evening, after the sun was down, and every thing serenely calm, I found the rascals extremely busy amongst my ears, and really very numerous. I immediately inclosed some of them in a light loose handkerchief; and by the magnifiers of my telescope, I took occasion minutely to examine them. They are a pale brownish moth, with little trunks or bodies, some trifle shorter than their wings; and as some of their little bodies appeared bulging as if loaded; I applied the pressure of a fine straw upon them, and saw them squirt out, one after another, a number of little things which I took to be eggs, some more, some less: some emitted fifteen or twenty of them; and others appeared extremely lank in their little trunks, which I could not make discharge anything like an egg. Whether they had done this in the field before, or were of the male kind, I could not tell; but from this discovery I concluded that there need not be above two or three flies to an ear of corn, to lay eggs enough to destroy the greatest crop. * * * It is with much propriety called a weevil, as it destroys the wheat even in our granaries; though it is not of the kind termed by naturalists the *curculio*, of which they have given a very long list; for it is not like a bug; it carries no cases for its wings; neither has it any feelers, with which the curculio is always distinguished; and perhaps (as I fancy it will turn out in the course of this letter that they never attack grain when hard) they really have no occasion for such feelers. For from the make of it, to my judgment, it appears an impossibility that it should ever perforate into a hard grain, being furnished with nothing in nature, from the most minute examination by glasses, that could make such a perforation; and seems indeed a fly itself, consisting of nothing sensible to the slightest touch with the finger, nor to the eye assisted with glasses, leaving only a little dry pale brown glossy dust on being squeezed."

I doubt not but that on perusing this extract, almost every reader who is conversant with our wheat-fly, which also is so frequently called "the weevil," will feel confident that it is the same insect to which Col. Carter alludes. Yet if his account be more particularly observed, we gather from it some characters which assure us that it was not the wheat-fly which he examined. Although he uses the terms *moth* and *fly* as synonymous, and no where tells us whether his specimens had four or only two wings, yet he could scarcely have spoken of the lively orange color of our wheat-fly as "pale brownish;" and what is yet more conclusive, his insect, on being pressed between the fingers, left "a little dry pale brown glossy dust;" whereas the wheat-fly leaves no mark upon the fingers, unless it be actually crushed, in which case its

From this it would appear that the effects produced by the wheat-fly had been known for some time to the farmers of England, though imputed by them to a wrong cause. He says, "What the farmers call the yellows in wheat, and which they consider as a kind of mildew, is in fact occasioned by a small yellow fly with blue wings, about the size of a gnat. This blows in the ear of the corn, and produces a worm, almost invisible to the naked eye; but being seen through a pocket microscope, it appears a large yellow maggot, of the color and gloss of amber, and is so prolific that I last week distinctly counted forty-one living yellow maggots in the husk of one single grain of wheat—a number sufficient to eat up and destroy the corn in a whole ear. * * * One of these yellow flies laid at least eight or ten eggs of an oblong shape on my thumb, only while carrying by the wing across three or four ridges."

It was several years subsequent to this date, that the accounts of the appalling ravages of the Hessian fly among the wheat crops of America reached Europe; and as this fly was universally believed to have been derived from the old world, extensive and careful examinations of the grain fields there were made to detect it, that its habits might be learned, and means devised for preventing its becoming such a scourge as it was to this country. These investigations, conducted often at the public expense, and by men whose acquirements peculiarly fitted them for such a work, resulted in a confident announcement, which received general credence for a long series of years, that the Hessian fly did not exist in Europe; yet in their course, several other species of insects injurious to the cultivated grains of that continent were discovered, and the wheat-fly received a particular examination. Mr. Curtis, generally so accurate in his statements, says that it was first discovered at this time; but the account already given from Mr. Gullet, shows that it was known in England at least twenty-five years earlier than Mr. C. supposes, and

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fluid juices produce a yellow stain, without any glossiness. Every one accustomed to the handling of insects, will at once recognize the character in question as applying admirably to some small species of moth; and the "Committee on Husbandry" of the Society, in their remarks at the close of Col. Carter's paper, are doubtless correct in their statement, that these insects "appear to be of the same kind with those that do the like mischief in Europe, which a gentleman of Angumois describes to Mr. Duhamel," and which have since become so well known as the "Angumois grain-moth," described by the naturalist Olivier under the technical name of *Alucita cerealella*.

anterior even to the date when the Hessian fly was first observed in America.

In 1795, as we are informed by Mr. Marsham, in a paper read before the Linnæan Society, London, and published in their Transactions, vol. iii. p. 142, towards the end of July, Mr. Long had observed an insect that threatened to do much mischief to the wheat crops, attacking one or more of the grains in an ear, and causing the chaff of these grains to become yellow or ripe, whilst the remainder of the head was still green. Mr. Marsham, on opening the chaff of these grains, found an orange-colored powder, and in many of them one or two very minute yellowish-white or deep yellow larvæ, the grain itself appearing to be a little shrunk. Mr. Markwick, of Sussex, also observed the same larvæ in his wheat, the forepart of August, but was confident they had done no injury to it. The same larvæ were also noticed by Mr. Kirby, this year, in Suffolk.

In a subsequent paper from Mr. Marsham (*Trans. Lin. Soc.* vol. iv. p. 224), we are informed that Mr. Markwick, July 12, 1797, saw the flies themselves, at rest upon the heads of the wheat, and also a few of the larvæ within the flowers ; and that awhile later in the season the fly appeared reduced in numbers, whilst the larvæ had become much more abundant. From heads of the wheat enclosed in a flowerpot, he reared the fly, and also its parasite ; the fly thus obtained having " spotted wings," a fact which we shall revert to hereafter.

Following this account is an excellent article (p. 230) by the Rev. William Kirby, who has since become so well known by his various writings upon entomology. Mr. Kirby here gives a scientific description of the wheat-fly, bestowing upon it the specific name *tritici*, by which it has been definitely distinguished by all subsequent writers, and correctly referring it to the genus *Tipula* of Linnæus, a genus which, in consequence of the vast number of species afterwards discovered to be comprised under it, naturalists have since found it necessary to subdivide ; and the species in question at this day falls within that group to which the name *Cecidomyia* was given by Latreille—an arrangement concurred in by Mr. Kirby himself in his communication in Loudon's Magazine of Natural History, vol. i. p. 227 ; and which I note thus particularly, as by most writers in our

agricultural papers it is still spoken of as solely the *Tipula Tritici* of Mr. Kirby.

In this article, and another presented about a year afterwards, (*Trans. Lin. Soc.* vol. v. p. 96), Mr. Kirby gives a large number of most interesting and valuable observations upon this insect, the correctness of which, generally, more recent investigations have fully attested. With regard to its abundance at that time, he says he could scarcely pass through a wheat field, in which some florets of every ear were not inhabited by the larvæ ; and in a field of fifteen acres, which he carefully examined, he calculated that the havoc done by them would amount to five combs (twenty bushels).

From this time we have met with no notices of the wheat-fly, except occasional references to the articles above mentioned, until the year 1828, when, and for a few of the following years, it again appeared in such numbers and with such havoc in several of the counties of England and Scotland, as to elicit communications in the magazines from several writers. In some districts of Scotland, its devastations would seem to have approached in severity what has been experienced upon this side of the Atlantic ; for "Mr. Gorrie estimates the loss sustained by the farming interest in the Carse of Gowrie (the rich alluvial district along the Isla and its tributaries in Perth and Forfarshire) by the wheat-fly alone, at 20,000*l.* in 1827, at 30,000*l.* in 1828, and at 36,000*l.* in 1829" (*Encyc. of Ag.* 3d Lond. ed. p. 820. § 5066). And Mr. Bell, writing from Perthshire, June 24, 1830, says, "We are anxious to have the present cold weather continue for another ten days, to prevent the eggs from hatching, until the wheat be sufficiently hardened and beyond the state which affords nourishment to the maggot. Another year or two of the wheat-fly will make two-thirds of the farmers here bankrupts," (*Gardener's Magazine*, vol. vi. p. 495). Mr. Gorrie, in a letter dated at Annat Gardens, Errol, Perthshire, Sept. 1828, (*Loudon's Mag. of Nat. Hist.* vol. ii. p. 292), solicits information "on the nature and mode of propagation of a fly which has this year destroyed about one-third of the late sown wheat all over this country." He describes a small yellow caterpillar, one-eighth of an inch long, as numerous in the young ears of wheat, completely devouring the young milky grain, becoming torpid in about twelve days, and in six days more changing to a small black fly. In a subsequent communication, August

1829 (p. 323), he corrects the latter part of the above statement, and says, "At that time I did not know that a yellow fly had deposited the eggs within the glume, which became maggots. Observing numbers of black flies on the ears of wheat, I believed they had been the produce of the caterpillar. I have this season, however, observed the yellow fly (described by Rev. W. Kirby) deposit its eggs in the wheat-ear," etc. I notice this more particularly, because the farmers in this vicinity, with scarcely an exception, have fallen into the same error, and to this day suppose a small black fly, of the family *Muscidæ*, which occurs abundantly in wheat-fields, to be the real wheat-fly.

Mr. Patrick Shirreff, of East-Lothian, gives, in the same volume of Loudon's Magazine, pages 448 – 451, an excellent and very accurate summary of the habits and transformations of the same insect, the result chiefly of his own observations. For a concise account, this is not surpassed by any that has fallen under my notice.

Still more recently, this subject has been investigated by the Rev. J. S. S. Henslow, Prof. of Botany in the University of Cambridge, whose valuable "Report on the diseases of wheat" forms the first article in vol. ii. of the Journal of the Royal Agricultural Society of England. And in the same Journal for the present year (vol. vi. p. 131. plate M.) an admirable production is inserted from the pen and graver of that accomplished naturalist, John Curtis, F. L. S., giving much more accurate and precise descriptions and delineations of the wheat-fly, in the different stages of its existence, than any that had previously appeared. To it I am particularly indebted for such characters as enable me to say without a doubt, that the clear-winged wheat-fly of America is identical with the English *Cecidomyia Tritici*.

In closing this summary of the notices of the wheat-fly abroad, I would allude to what has occurred to me as perhaps true in the history of this insect, to wit, that it has somewhat *regular periods of recurring* in such numbers as to become a pest to the agriculturist. Thus, it is manifest from Mr. Gullet's account that it was abundant for a few years previous to 1771. So destructive was it then, that he pronounces "these small insects—the wheat crop's greatest enemy." After an interval of twenty-five years, it is again observed plentifully for three or four years, and in different districts, by Messrs.

Kirby, Markwick and Long. Again it ceases to elicit attention, until a period but a little longer elapses, when, in 1828 and the following years, it forces itself once more and still more prominently into notice. All that I design, is to direct attention to this point: the facts are as yet too few and too vague to justify anything more than a suggestion. The observations of Mr. Kirby, reaching now over half a century, could probably shed some light upon this most interesting topic.

As respects the *extent of its range abroad*, it has been noticed in most of the southern and eastern counties of England, from Cornwall to Norfolk, and also in Shropshire; in Perthshire and the Lothians, and probably in other districts of Scotland; and in the north of Ireland. Whether it occurs upon the continent of Europe, we are not positively informed. It is not noticed by Macquart, either in his Diptera of the North of France, or his Natural History of Dipterous Insects (for a perusal of which I am indebted to the courtesy of Dr. T. W. Harris of Harvard University;) and we can scarcely believe that if it existed in his district, it could have been overlooked by so assiduous a naturalist. M. Herpin, however (as we are told by Mr. Curtis,) is of opinion that it is an inhabitant of France, and the statement which he makes strongly supports this opinion. He says, "I have also found in ears of corn, at the time of flowering, many little yellow larvæ, very lively, from two to three millimetres long, lodged between the chaff of the grain: these larvæ nibble and destroy the generative organs of the plant, and the germen where they are found are sterile. These larvæ appear to me to have a very great analogy with those which have been described in Linnæan Transactions, under the name of *Tipula Tritici:* it is probably a *Cecidomyia*." M. Herpin placed several ears of diseased barley and wheat in bottles, and in these bottles a number of Cecidomyia flies were afterwards found. Meigen—a copy of whose noted work upon the Diptera of Europe I regret that I have been unable to meet with—as I learn from Mr. Curtis's paper, gives descriptions and figures of the wheat-fly. Were his specimens collected in Germany, or received from England?

ITS DOMESTIC HISTORY.

It will be unnecessary to particularly specify the various notices of this insect, that have appeared in the different agricultural papers of the Northern States during the last twelve years. The more important and valuable of these may be found in the several volumes of the Cultivator and of the New-England Farmer. An excellent summary of the history and habits of the wheat-fly, both in this country and abroad, is also given in Dr. Harris's Report on the Insects of Massachusetts, p. 437–444. Mr. Gaylord's paper on injurious insects briefly notices this species (*Trans. N. Y. State Agric. Society*, 1843, vol. iii. p. 145–147.)

With the prominent facts that have been laid before the public by our agricultural periodicals, every intelligent farmer is already familiar. The great difficulty experienced by persons but little conversant with zoological science, in determining what this wheat-worm really was, forms a striking feature in the earlier notices that appeared respecting it. Thus, by some it was for a time regarded as an animalcula of the *vibrio* genus, analogous to the "eels" generated in vinegar and paste. By others, and quite extensively, it was pronounced to be a *weevil*, and this very improper name is to this day often applied to it. Others, still, deemed it to be "Monsieur Tonson come again," considering it as a return of the *Hessian fly* to a section of the country from which it had long been absent. It would be easy to point out how erroneous each of these opinions are; but I deem it wholly unnecessary, as the public mind is now no longer distracted upon this subject; and the correct view, that this insect is a fly, peculiar in its habits, and differing from any of those previously known in this country, universally prevails.

It is not improbable but that one or both of the species of the wheat-fly may have been present in this country, in limited numbers, many years before it was distinctly noticed. In truth, common as this insect still is in this district, if our farmers, guided by the knowledge they have acquired of it, were not zealously searching for it in every field, I much doubt whether it would be at all observed here at the present day. And often too when a careful examination of the growing grain leads to a belief that the crop is scarcely infested, an inspection of the threshing-floor, or of the screenings of the fanning-

mill, will frequently demonstrate that it was present in much greater abundance than was surmised. These facts plainly show, that this insect *might* lurk a long time in our country wholly unobserved.

Mr. Jewett says the wheat-fly first appeared in western Vermont in the year 1820, (*New Eng. Farmer*, vol. xix. p. 301.) It was not, however, till the years 1828 and 1829 that it became so numerous as to attract the attention of community; the same years, be it observed, when its ravages were so annoying in Scotland. It was in the northern part of Vermont, bordering upon the line of Lower Canada, where it became so excessively multiplied at this time; and from that, as a central point, it seems to have extended in nearly all directions. In this vicinity, one hundred and twenty-five or fifty miles south of the locality above indicated, it was certainly observed in 1830; and in 1832 the wheat crops were so completely destroyed by it, as to lead to a general abandonment of the cultivation of this grain. This was the year in which the malignant cholera swept over our land, and it was a common remark, that what the pestilence spared famine bade fair to destroy. Having spread east over Vermont and New-Hampshire, it in 1834 appeared in the State of Maine, and continued to advance in that direction, it is said, at the rate of twenty or thirty miles a year. Westward its progress would seem to have been less rapid, and along the Mohawk river by no means so generally destructive. It is not till within a year or two past, that it has appeared in the Black river country east of Lake Ontario, as I am informed by an intelligent gentleman resident there; nor until the present season that it has been so injurious as to induce in some instances a premature mowing of the crop, and preserving it for hay. Rumor states that farther west, in the wheat-noted Genesee country, it has been detected for the first time the present year.

The *amount of injury* inflicted by this insect will be more distinctly and vividly realized, if we can arrive at some approximation to the sums of money that have been lost to certain districts in consequence of its presence. The Maine Farmer, vol. xiv. No. 2, states that "a million of dollars, nay, more money, would not pay the damage it has done to the state of Maine, alone." Half of that sum, it is probable, would not repay the loss which has been sustained merely in Washington county, N. Y.—a county embracing (the untilled mountain district bordering upon Lake George being deducted,) a population of about

35,000 souls, and an area of 700 square miles, of which nearly 500 are cleared and improved.

Lest this statement should be deemed extravagant by the reader, I will adduce the data on which it is founded. When it is considered that the entire crop of 1832 was almost totally destroyed—that the crop of the previous year was much injured, and that for several of the subsequent years the man was deemed fortunate who received but half of a fair yield per acre—many obtaining back but little more than the amount of seed which they committed to the ground. I say, when these facts are duly considered, I think it will be regarded as but a moderate estimate if we set down the total amount of loss during the fourteen past years, as equal to the entire crops of three years, under ordinary circumstances. Had the usual quantity of land been all along sowed with wheat, the loss would doubtless have been double that which we here are supposing it to have been. What, then, was the amount of the ordinary wheat crops in this country, formerly? No statistics, that I am aware, were then taken, by which this point can be definitely ascertained. But in 1844—the crop of which year is commonly supposed to have been about a third or a fourth less than what was required for the consumption of the country—according to the census returns, 75,500 bushels were produced.

Now, since the county formerly not only supplied its own wants, but transmitted a considerable surplus annually to market, it is probable that the yearly crop previous to the appearance of the wheat-fly, was twice or thrice what it amounted to in 1844, which would be from 150 to 200,000 bushels, the value of which for three years, gives us the sum first stated, half a million of dollars. And this estimate, be it observed, only contemplates the grain that has been destroyed, without taking into consideration the detriment that has been indirectly sustained by our farmers in being driven to a cultivation of those coarser grains which have yielded them a much less profit.

The adjoining counties of Rensselaer and Saratoga, and the five western counties of Vermont, constituting the district over which this fly first swept and where perhaps its ravages have been most severe, have probably suffered in about an equal degree with Washington county. Together they embrace an area about six times greater than that of Washington county. The whole of this district is therefore about equal in extent to the State of Connecticut, and the amount of

loss from the wheat-fly, upon the data above indicated, may be set down at *three and a half millions of dollars!*

The history of the career of this insect, appears to be quite uniform in most of the districts hitherto visited by it. About two or three years after its first arrival at a particular locality, it becomes most excessively multiplied, and the devastations which it now commits are almost incredible. Though I believe that, through unduly excited fears, or a hope of thereby destroying hosts of this marauder, a mowing of the crop whilst yet green and a curing of it for hay has often been resorted to, when, had it been harvested as usual, a less sacrifice would have been made—yet many cases have occurred in which diligent search by different persons has failed to discover a single developed kernel of grain in any of the heads of an entire field!

This havoc, so extreme and general, though not universal (for some fields even now escape with comparatively little injury,) lasts but a few years. The numbers of the pest and its consequent ravages soon become sensibly diminished ; and after the lapse of some seasons, the cultivation of the wheat crop is again found to be comparatively safe, and its yield only in isolated instances materially lessened by the continued presence of the fly, which has now become probably a permanent inhabitant.

It is now commonly supposed that this rapid diminution in the numbers of the wheat fly has been produced by the general abandonment of the cultivation of wheat in this section of the country ; that thus the insect, having no place to deposit its eggs where its young could be nourished, has become measurably "starved out." But that this opinion is erroneous, is I think evident from one or two facts. During this entire period, since notice was first attracted to the wheat-fly, there are some farmers who have every year continued the cultivation of wheat with very fair success, their crops having been in no one of these years so severely injured as to dishearten them ; and their respective situations are so dissimilar, that this immunity can with no plausibility be attributed to any peculiarity in the location of their farms. Now if the swarms of these insects which for a time pervaded every neighborhood through this entire section of country, and which possess a power of wing capable of bearing them from twenty to fifty miles in a single season, had been in the "starving" condition supposed, how have the fields alluded to escaped destruction? Certainly these myriads of tiny

creatures could not have been reduced to such straits for want of the appropriate repository for their eggs, until after these crops have been utterly consumed. And, with the insect not exterminated, but still everywhere common, now that the culture of wheat has been gradually returned to with such success that it has again become general, why has not the fly again increased? Why have the considerable crops of the past and the abundant ones of the prescnt year (1845) in this county, been so little injured? I am firmly persuaded, therefore, that the speedy diminution in the numbers of the wheat-fly, which soon follows a season in which it has been extremely annoying, can not be truly assigned to thc cause above stated; but that it is rather to be attributed to that beautiful provision of nature long since observed, and additional instances of which are brought to light by the investigations of every year, to wit, that an undue increase in any of the species of the animal or vegetable world never takes place, without being speedily succeeded by a corresponding increase of the natural enemies and destroyers of that species, whereby it again becomes reduced to its appropriate bounds.

Whenever once introduced, it is probable the wheat-fly will ever after continue in limited numbers, laying the wheat crop annually undcr a moderate contribution for its support. Isolated fields will occur where its devastations will be quite serious, whilst the crop of the district generally will suffer but little, and many fields none at all. Such has appeared to be its history in this vicinity for several years past. Seasons favorable for its multiplication will doubtless occur, when its injuries will be much augmented; as well as seasons of a reverse character, when its presence will scarcely be known. It is therefore very important that the entire history and habits of this insect should be accuratcly traced out. For only with a full knowledge of these, can we be able to resort intelligently to such measures as will keep its numbers constantly limited, or sweep it from those fields that will probably at times be excessively infested by it.

ITS HABITS.

Relying upon the correctness of the published statements, that it was not till "towards the last of June" that the fly infests the wheat-fields, and that the "principal deposit of eggs is made in the first half of July," I had not commenced searching for it, when on the

16th of June I was informed by a neighbor, that it had been present for some days in large numbers, in a field of thrifty winter wheat of his. Upon repairing to this field, a small black fly, about one-third of the size and much resembling the common house-fly, was pointed out as the dreaded enemy; and so universally has this doubtless harmless species been for years regarded as the true wheat fly by the farmers throughout this whole section of the "infected district," merely from the circumstance of its occurring abundantly in wheat fields simultaneously with the wheat-worm, that my companion was much surprised, and disposed to be incredulous of my assertion that *that* was not the wheat-fly. On opening the flowers of wheat, however, the eggs of the real marauder were found in abundance; and a sweeping, with the small gauze fly-net in common use by entomologists, between the stalks of grain towards their roots, immediately caught within it a number of the winged insects. My comrade was little less surprised on my pointing the real fly out to him, being scarcely able to conceive that such a tiny fragile atom, seemingly a mere moat floating before his eye, could be that potent enemy that had spread such desolation over our land. Several of the specimens thus caught, were of the spotted-winged species. These I conjectured, until I afterwards came to examine them attentively with the microscope, were only a variety of the common or clear-winged species, else I should not have failed to have regarded them more particularly.

All parts of this field of four acres were found to be infested more or less with the wheat-fly, but they occurred most abundantly along one of its sides, in the field adjoining which, wheat had been grown the preceding year, which had been considerably injured by this insect. Such a host of destroyers as were here found, and the profusion of eggs that had been already deposited, strongly indicated that it must have commenced appearing in its winged state many days previous to this time.

The wheat-fly may be met with daily, from the fore part of June, until so late at least as the middle of August. Although it congregates in swarms about fields of wheat at the time they are in blossom, it also occurs in a great variety of other situations. It often enters houses, upon the windows of which it may be observed dancing along the panes, sometimes in numbers. It may also be taken among the grass of pastures, and of alluvial meadows that have never been turned up

by the plow. It is sometimes found in shady places, particularly along the margin of streams, associated with other minute species of *Tipulidæ* in those dances in which swarms of these insects so often engage. One specimen was met with on weeds, in the margin of an extensive and dense forest, through which it must have made its way, or over an adjoining lake a half mile broad, on the opposite side of which was the nearest cultivated ground.

The fly during the sunshine of day moves about but little, remaining mostly at rest or lurking about in the shade furnished towards the roots of the growing grain. In the twilight of evening it becomes active and continues so perhaps during the entire night; for before the morning sunrise it may be seen abundantly upon the wing, though less agile than in the evening, as though it had now become somewhat wearied or was rendered sluggish by the coolness and dampness of the night air. Upon cloudy days, also, it resorts but little to its usual retreats. In short, it appears to be only the direct rays of the sun which it avoids, for if a tree be standing in an infected wheatfield, the fly may be met with in its shade, on the wing and depositing its eggs at mid-day. Hence those parts of a field shaded by trees or an adjoining wood, have been repeatedly observed to be severely devastated or even entirely destroyed, when the other parts of the same field have been but moderately injured.

But it is during the evenings which succeed hot days of sunshine that the fly appears to be most busy and full of life. If a field infested with them be visited with a lantern at this time, such hosts as were little imagined to exist, will be found busily hovering about the grain, the most of them with wings and legs extended, dancing, as it were, slowly up and down along the ears, intently engaged in selecting the most suitable spot where to deposit their eggs. This being found, the insect alights, and standing upon the outer glume or chaff of the kernel, curves its abdomen so as to bring the tip in contact at right angles with the surface of the glume. It now toils industriously to insinuate its ovipositor through the scale, which is not accomplished till after a considerable exertion. Sometimes even, the scales having probably acquired too much maturity and hardness to be pierced by the tiny stinger which the fly protrudes, it is foiled in its efforts, and, as if vexed at its ill success, spitefully jerks its wings apart and darts away. This occurrence, however, is rare. And having penetrated with its

ovipositor into contact with the germ of the future grain, through this tube one egg after another is passed in at short intervals until several are deposited. The usual number of eggs thus deposited, appeared to be from six to ten; and as thrice or four times as many larvæ can sometimes be met with on a single germ, it is probable that three or four insects sometimes successively puncture the same floret. Very frequently two, four or six flies may be seen at the same time on different florets of the same ear, depositing their eggs; and Mr. Shirreff says, "Upon one occasion I numbered thirty-five flies on a single ear, and, after carrying it a distance of a quarter of a mile, six of them still continued to deposit eggs." This work being done, another laborious task for the tiny creature remains, that of withdrawing the ovipositor; and to accomplish this, the energies of the insect are sometimes inadequate, and it remains, Prometheus-like, chained to an immoveable mountain, until it expires. This curious fact, first observed by Mr. Kirby, I have seen fully verified, meeting in several instances with the dead insect still remaining thus suspended.

Although the flowers of the wheat are the favorite resort of this insect for depositing its eggs, yet it is not limited solely to this plant. It is currently reported to have been occasionally met with in rye and oats in this country. Mr. Shirreff and Mr. Gorrie both found the wheat-worm in ears of the quack or couch grass (*Triticum repens* Linn.; *Agropyron repens*, Pal. de Beauvois); and the latter gentleman hereupon rather naively remarks, "The fly has not known that modern botanists no longer ranged the couch grass among the wheat tribe; but, like myself, it is most attached to the Linnæan names and systems." Mr. Markwick also found the same worms in the wild bearded oats (*Avena festuca*, Linn.)

The *eggs* are of an oblong, cylindrical form, with rounded ends, They are pellucid and nearly colorless at first, but acquire a yellowish tinge ere they are hatched, which is in rather over a week after they are deposited.

The *larva* has two distinct stages in its existence: an *active* or growing state, which is passed through in about a month; and a *dormant* state, which then supervenes, and continues through the winter. This latter has been generally but incorrectly regarded as its pupa state by writers.

When it comes from the egg, the larva is a minute oblong soft

worm, without feet or hairs, and transparent or of a whitish tinge at first, but soon changing to a bright amber or orange yellow. It moves but slowly, and with difficulty, by a wriggling motion of its body. It remains within the particular floret in which it is hatched, until it attains its full growth. Mr. Kirby says it feeds upon the pollen of the anthers; and perhaps it does so at first, but certainly whilst they are quite small, all the worms within the floret cluster upon the sides of the germ, and generally towards its base (Plate 5, fig. *a*.) I apprehend they chiefly subsist and attain their growth there, upon the fluids destined for the nourishment of the germ, and which, for want of these fluids, becomes shrivelled to a greater or less degree, and does not attain that plump form on which the value of this grain so much depends. The amount of injury received by the individual kernel of grain varies according to the number of worms that have been nourished in the chaff in contact with it. If mature worms grow from all the eggs deposited by the fly at a single puncture, the kernel is doubtless rendered worthless; but a single worm, as is occasionly found, would scarcely produce a perceptible effect.

Having attained its growth, and in its dormant state, it does not differ sensibly, as I have been able to discover, from its previous appearance; and the only reason for marking this as a distinct stage, is, that the insect now remains for a long period (probably two-thirds of its entire term of existence) without increasing in size or undergoing any other perceptible change. The texture of its body seems to have acquired rather more firmness than it possessed while it was growing, and its motions are more sluggish. It is less than the tenth of an inch long: a measurement of several specimens gives 0.07 as their average length. It is of a rich orange color, and of an oblong-oval form (Plate 5, fig. *b*), being broadest in the middle and rounded at each end: it is slightly depressed, the under side being considerably flattened; thus in form somewhat resembling the leech when contracted. Its joints are indicated by slight transverse impressed lines, by which it is divided into twelve segments of about equal length. Sometimes a brownish cloud is perceptible near the middle of the body on its underside, which is probably caused by alimentary matter. If these worms are placed for some days on a plate in a dry room, the outer skin of the body becomes so dry and

indurated that the worm is incapable of making the slightest motion ; but on covering them with a wetted cloth, the surface again in a short time becomes pliant and yielding ; and if pressed with a needle, the animal writhes, and sometimes turns itself over to escape from the annoyance. I doubt whether it ever moults, or casts off its skin, between its egg and its pupa state ; but my observations have not been sufficiently exact and prolonged to speak positively upon this point.

This is the form in which the insect passes the autumn and winter. The accounts of writers disagree as to where the worm remains during this period ; in fact few of them speak distinctly upon this particular point. Mr. Kirby, however, describes the worm as still continuing in the heads of the wheat ; but as a considerable portion of them are missing, he thinks these have been destroyed by parasitic enemies. He says, "I have seen more than once, seven or eight florets in an ear inhabited by the [active] larvæ, and as many as thirty in a single floret, seldom less than eight or nine, and yet I have scarcely found more than one pupa [dormant larva] in an ear, and had to examine several to meet with that." Mr. Gorrie, on the other hand, asserts that the maggots quit the ears of the wheat by the first of August, and enter into the ground, where they remain through the winter. Mr. Shirreff, also, from finding the fly much more abundant in fields where wheat had been grown the preceding year than it was in other fields, entertains the same opinion. Now the truth is, Mr. Kirby and Mr. Gorrie are both right. A portion of the larvæ leave the grain before it is harvested, and descend to the ground, where I have found them, under mouldy fragments of straw on the surface, or buried a half inch or less within the soil. I thus found them, common in the field already spoken of as examined on the 16th of June, a few days after the grain was harvested ; and also early in March, in a field in which wheat was grown the preceding year, that had been somewhat injured by the fly. Another portion of these larvæ remain in the heads of the wheat, and are carried into the barn, where they may readily be observed upon the threshing-floor, and found in quantities among the screenings of the fanning-mill, a considerable portion of which sometimes consists of these worms. Thence our farmers *kindly* empty them out at the door of the barn, where most of them doubtless find among the litter

of the yard a bed equally as comfortable and secure as that in which their brethren in the field are at this time reposing.

Whence does this singular diversity in the habits of these larvæ arise? All the worms are undoubtedly fully matured before the grain becomes ripe and dry and hard. Why then do one part of them leave the wheat heads and enter the ground ere the harvest—and another portion of them remain within the ears to be carried into the barn with the grain when it is housed? Two well attested observations, I think, shed important light upon this interesting point. And if the inference which I deduce from them be correct, we have arrived at another very curious trait in the economy of this insect.

Dr. Harris informs us, that "after a shower of rain, they [the larvæ] have been seen in such countless numbers *on the beards of the wheat*, as to give *a yellow color to the whole field;*" and he refers to the New-England Farmer, vol. xii. p. 60, in confirmation of this statement, a volume which I have not at hand. For an analogous but still more instructive fact, I am indebted to Gen. M'Naughton, a practical farmer of this town, the accuracy of whose statements no one acquainted with him will doubt. In 1832, his wheat, in which the fly had made sad havoc, was cradled and lying in the swath, when a moderate rain came on, followed by a damp cloudy afternoon. At this time, with his hired help, he repaired to the harvest-field to bind up the grain. They here found not only the heads, but also *the straw in its entire length sprinkled over with these worms.* On my observing to him, that I could scarcely believe it possible for a footless worm to crawl along the straw when it was lying horizontally, he stated that he was particularly positive with regard to that fact; for he distinctly recollected that it was impossible for him to draw the band around a bundle and tie it [in which process the heads of the grain are not touched,] without having at least a half dozen of these worms adhering to his hands.

From these facts, I infer that the worm does not crawl out of the chaff and "drop" itself to the ground, as has been stated by some writers; but that having attained its growth, it lies dormant within the chaff, awaiting a favorable state of the weather in which to make its descent, to wit, a rain which is not immediately followed by a clear sky and warm sun that would soon dry the straw. Hence it is doubtless almost invariably by night that this journey of the worm

is performed, and that it has therefore never been seen. The straw itself being wet, and the body of the worm rendered supple by the moisture surrounding it, it leaves its abode in the head of the wheat, and adhering to the wet straw by the glutinousness of the surface of its body, gradually works its way downwards by the wriggling motion to which it so often resorts when disturbed, until it reaches the ground. That there is such a glutinous secretion upon the surface of the worm as would enable it to adhere to the wet straw in the manner supposed, I might adduce a number of facts to prove. I was desirous of taking a drawing of the larvæ which I found among wheat-stubble last March ; but particles of earth adhered to them so firmly, that I could not separate them with the point of a needle without also mutilating the worms. A few weeks since, on visiting a neighbor's threshing-floor, I gathered a number of larvæ by moistening the end of my finger and touching it to the worm, which, thus adhering, was scraped off upon the edge of a tin box. The box is now before me, with each of the worms alive, but firmly glued to its sides, and many of them to each other ; and on forcibly removing some of them, the outer dried and hardened case of the worm is fractured in the operation.

It would thus appear that those worms which are matured, leave the grain at the close of a shower, and crawl down the wet straw to the earth. It may be also, that a heavy night-dew sometimes furnishes a sufficient degree of moisture to enable them to do this. But on the other hand, those worms which are later in arriving at maturity, in awaiting suitable weather for making the same descent are, ere such weather arrives, carried with the grain into the barn.

As illustrating the strong tenacity of life possessed by these larvæ, I may in this connexion state, that the few specimens gathered in March as already stated, were placed with a little earth in a vial, and a piece of gauze tied over its mouth, for the purpose of ascertaining the transformations of the insect, if any, from its then condition to that of a winged fly. Other avocations diverted my attention, and this vial was forgotten for a fortnight ; by which time the earth within had become so completely dried, that not doubting but the worms had all perished, no farther attention was paid to it, and it remained in a dry room over three months, until the middle of June, when, on examining it, half the specimens put into the vial were found to have

completed their transformations ; a corresponding number of dead wheat-flies being found attached to a straw in the upper part of the vial. Prof. Henslow thinks that it is only those larvæ that are punctured by ichneumons, that leave the wheat-ears and enter the ground ; but the facts now stated show that this opinion is erroneous.

On removing the earth from the vial above alluded to, the cases of the *pupæ* from which the flies had proceeded, were found very perfect. These conclusively showed that the real pupa is not formed until in the spring, and that it is then altogether different in form from what has been described by writers as its pupa. It corresponds identically in its appearance (perhaps with the exception of color) with that of the *Cecidomyia Salicis*, as exhibited in the first volume of the American Quarterly Journal of Agriculture and Science. Plate 2, fig. 1. It also closely resembles the figure of the pupa of *Cecidomyia Pini ?* as given from De Geer in Westwood's Introduction to the Modern Classification of Insects, vol. ii. p. 518, fig. 125, No. 7.* Its length is slightly less than that of the dormant larva. The antennæ, legs and wings, are each enclosed in separate sheaths, which lie externally to the integument in which the body is enveloped. The three pairs of legs all lie parallel and in contact with each other upon the breast, reaching far down past the tips of the wings ; the inner pair being shortest, and the outer pair longest. Judging from the analogy afforded by the *Cecidomyia Salicis*, I presume the wheat-fly only remains in its pupa state three or four weeks in the latter part of May and the fore part of June.

ITS NATURAL ENEMIES.

One of the most effective natural destroyers of the wheat-fly, is undoubtedly our common yellow-bird (*Fringilla tristis*, Lin.) Fields much infested by the insect, have been for many years recognized even by passers on the highway contiguous to them, by the rough and ragged aspect of the heads of the grain (Plate, fig. *c*). I am not aware that the cause of this peculiar appearance has ever been stated in any of the communications that have appeared in our agricultu-

* I cannot but regard the figure here referred to as inaccurate, in representing the wings as enclosed in one common case, *over which* the legs are laid. The tips of the wings should probably be rounded, instead of being brought to a point.

ral papers. It results from the operations of this bird. Alighting, it adroitly grasps the wheat stalk just below the ear, and clinging fearlessly to it, even when swayed to and fro by the wind, it with its bill parts down the chaff from the grain, and one after another of the worms to which it thus gains access are rapidly picked off and devoured. Thus several heads are generally freed from the worms, ere its repast is completed. That it is the worms and not the grain that it is in pursuit of, is readily ascertained by an inspection of the heads after the bird has left them: many of the kernels, not being sufficiently loosened to drop to the ground by the operation, will be found remaining, the maggots that were upon them only having been removed; whilst those kernels of the head which are not infested by the worm, are passed over untouched. It is curious that this little creature, by a tap with its horny bill, or some other process, is enabled to distinguish those scales of chaff which conceal so minute a worm, from those which do not; a knowledge which we only arrive at when we have parted down the chaff. A flock, numbering about fifty, embracing both male and female birds, appeared to make the field which I examined on the 16th of June their constant resort, for a period of three weeks or more, where they could be seen busily occupied almost constantly every day. The number of worms consumed by them during this time must have been immense; and I cannot but believe that this lovely bird will henceforward be esteemed for its utility, as much as it has heretofore been for its beauty.

I have as yet found but one insect parasite, which I am well assured subsists upon and destroys the worm of the wheat-fly. It is a hymenopter of the family *Chalcididæ;* but my acquaintance with the details of its history is as yet too limited to attempt an account of it. I shall be much disappointed if I do not meet with still other species which prey upon the wheat-fly; and as all these parasites upon the Cecidomyiæ are more or less closely related to each other, they can probably be most advantageously presented in a separate article devoted exclusively to that subject.

Four or more species are known abroad, which destroy the wheat-worm. One of these, it is stated in the first volume of the Edinburgh Quarterly Journal of Agriculture, deposits an egg beside an egg of the wheat-fly, the worm from which devours the wheat-worm soon after it hatches, and thus effectually saves the wheat. The observations of

Mr. Shirreff upon another of these cannot but interest the reader. He says, "Upon presenting four larvæ (of the wheat-fly) to an ichneumon, it soon stung, or, according to Mr. Kirby, deposited an egg in each of their bodies, and stung one of them a second time. The maggot writhed in seeming agony, and straggled upon my thumb-nail, where it was again stung three times by the same fly; and in a second struggle, both fell to the ground."

ARTIFICIAL MEANS FOR ARRESTING ITS RAVAGES.

These may be divided into two classes, as they refer to the protection of the grain from the fly when in its winged form and depositing its eggs; or as they directed to the destruction of the fly itself, in the previous stages of its existence.

Several measures have been proposed, and some of them with much confidence and plausibility of reasoning, for protecting the wheat crop from this insect during the period of its blossoming. The more prominent of these I will advert to.

The smoke of a number of smouldering fires, or of brimstone matches, in different parts, and particularly upon the windward side of an infested field, has been recommended. The known efficacy of smoke in repelling the musketoe renders it probable that this remedy would be of signal utility, were it not for the discouraging amount of labor that is required to make so thorough and protracted a use of it as would be necessary.

It has been suggested that the anal follicles of the skunk (*Mephitis americana*, Desm.) might be extracted, and that yarn impregnated with the fluid contained in them, and suspended through wheat-fields, would, by its intolerable odor, banish the wheat-fly. I imagine that in carrying this suggestion into practice, the operator would be *the greatest sufferer*—"unless *my nose* deceives me."

Sowing the field with lime at the time the wheat is in blossom, has been repeatedly, and by some with much confidence, urged. This remedy has been much resorted to, and very conflicting statements with regard to its efficacy have been laid before the public. A simple experiment, directly to the point, is of more value than a thousand cases that *tend to support* any particular opinion; and such an experiment I am prepared to narrate. Jarvis Martin, Esq., the owner of the infested field repeatedly alluded to, at my suggestion, repaired to it one

evening, and sprinkled several of the heads with tolerably fresh air-slaked lime, until they were white with the powder adhering to them ; thus applying it far more profusely and effectually than can be accomplished by any " sowing" of this substance. With the light of a lantern, these heads were now closely watched, and the flies were observed to hover around and alight upon them as freely, and insert their ovipositors with the same readiness that they did upon the contiguous heads that were not thus treated. I deem this experiment sufficient to put to rest the much mooted question with regard to the utility of lime as a shield against the wheat-fly.

A yet more prominent, and much more plausible mode of enabling the wheat to escape injury from the fly, is, sowing the seed at such times as will prevent its being in blossom at the period when the insect appears. With this view, it is recommended to sow winter wheat much earlier than was ordinarily done, that it may be so far matured the following season at the time of the appearance of the fly, as to be invulnerable to it ; and spring wheat, so late as not to be in blossom until the fly has finished depositing its eggs. This plan has been much relied upon, on both sides of the Atlantic, and I have been heretofore disposed to regard it as probably the most feasible of any—though by avoiding Scylla we are in danger of Charybdis—for early sown winter wheat invites a return of the Hessian fly, and late sown spring wheat is almost certain in this vicinity to be attacked by " the rust" (*Puccinia graminis*). Numerous instances, moreover, can be adduced which tend much to support the utility of this measure. One of these, as strong as any that has come to my knowledge, I may here state. In a field of spring wheat of my own, raised in 1843, every kernel in the top of almost every head was entirely destroyed, whilst the lower two-thirds or three-fourths of the ears were wholly uninjured. I could account for this only by supposing that these heads were just beginning to be protruded from their sheaths as the operations of the fly were closing for that year ; and hence confidently inferred that if that wheat had been sowed a few days later, it would have escaped entirely, or a few days earlier, it would have been entirely destroyed. By a reference to my Farm Book, I find this crop was sowed April 26th, and cradled August 10th, but no note was taken of the time when it was in blossom. I must confess, however, that my observations the present season have greatly diminished my confidence in the time of

sowing as securing the crop from injury. Though I did not see the fly abroad until the 16th of June, it was then present in such swarms, and had already deposited its eggs so profusely, that I think it must have commenced appearing quite early in that month. It, moreover, continued to be abundant until about the middle of July, and specimens were occasionally met with a month longer. Certainly if it is usual for it to be spread out over such an extent of time, it will be vain to rely upon the time of sowing to insure a crop against its ravages. Some observations in the foreign accounts also throw light upon this subject. Mr. Shirreff says, in 1829 the fly appeared June 21st; "and from the vast numbers of them then seen, it is probable a few of them may have been in existence some days previous." Their eggs were seen June 23d, and must therefore have been deposited on the evening of the 22d. "The flies were observed depositing eggs on the 28th, and finally disappeared on the 30th of July, thus having existed through a period of thirty-nine days," and depositing eggs during thirty-seven of these days. I know not how Mr. S. could be certain that the fly had disappeared for the season on the 30th of July, for his account is dated the first day of August. For a few days only after their first appearance, he tells us, they frequented the couch-grass as well as the wheat. Was not this because there was not at that time a sufficient quantity of wheat in bloom to accommodate the number of insects that were then out? And Mr. Markwick distinctly states that it was after the grain had been harvested, that he found the larvæ in the wild oats. Were not the parent flies then obliged to resort to this plant, because all the wheat had become mature ere they had completed depositing their eggs? These facts certainly make it appear as though the fly is often abroad before the wheat commences blossoming, and continues till after it becomes mature.

Is there then, no mode by which the flowering grain can be shielded from the ravages of the fly? This is a subject on which I have bestowed much thought; and I am not now prepared to tell the reader what *he must do*, but I will briefly inform him what *I shall do*, upon the first occasion that calls for it. A method is sometimes resorted to abroad, for saving grain fields from the depredations of certain insects of peculiar habits. A rope is drawn along over the grain by two men walking at a brisk pace; which rope thus knocking against the heads of the grain, causes the depredators to drop

themselves instantly on the ground, and it is a slow and tedious task for them to get up to the heads of the grain again. A similar process, but with a different apparatus, I contemplate employing against the wheat-fly. This apparatus is a light net made of gauze, three or four feet deep and one or two rods long; its mouth reaching the entire length of the net, and opening to a width of about eighteen inches. A small rope is to be stitched to the upper and another to the lower side of the mouth, reaching slightly beyond the net at each end, which is to be carried by two persons holding the ends of these ropes. If on closely examining the wheat-fields of my vicinity, from the time that the heads begin to protrude from their sheaths, the fly is found to be gathering in swarms in any one of them, I intend repairing to that field in the evening, when the insects will be hovering in such myriads about the heads of the grain, and, with an assistant, carrying the net so that the lower cord will strike a few inches below the heads of grain, the upper one being held nearly a foot in advance of it, and about the same distance above the tops of the heads, by keeping the cords tense and walking at a uniformly rapid pace from side to side of the field, until the whole is swept over, I shall be much disappointed if *countless millions* are not gathered into the net, which is to be instantly closed whenever a pause is made, by bringing the cords together. It is now to be folded or rolled together into a smaller compass, and then pressed by the hands or otherwise so as to crush the vermin contained within it. This measure has been suggested to me, by observing the perfect facility with which the small entomological fly-net becomes *filled* with these flies, on sweeping it to and fro a few times among the heads of infested wheat in the evening. Of course this operation should be resorted to on the first appearance of the fly in numbers, and before its eggs have been deposited so profusely as will occur in the course of a few days. I feel strongly confident, that by sweeping over a field a very few times in the manner above described, the fly may be so completely thinned out and destroyed, as to be incapable of injuring the crop perceptibly.

With regard to destroying the fly in the earlier stages of its existence, only a few words will require to be said. Whoever has read the preceding account of the habits of this insect, must have been struck with a consciousness of the perfect facility with which that

portion of the worms that are brought into our barns may be exterminated. It would seem as though Divine Providence had expressly designed to place a part of every generation of these insects directly in the hands of man, that he might destroy them or not, at his option. And Uncle Toby is so extremely benevolent, that he has uniformly carried them to the door, and said "Go away, little flies, go away; the world is wide enough for you and me both." Now it is scarcely necessary for me to say, that the screenings of the fanning-mill should invariably be closely examined, and if the minute yellow wheat worms are numerous in them, the person should consider it a sacred duty which he owes to himself and his neighbors, to consign these screenings at once to the flames. If there are but occasional worms among them, let them be emptied into a hog-trough; but never empty them upon the ground, or among the straw of the barn-yard, unless they appear to be entirely free from these vermin. And now, if that portion of the worms which remain in the fields can also be destroyed, it becomes certain that we are at once and forever relieved from all farther solicitude with regard to future injuries which this insect can inflict upon us. But can this be done? It has been proposed to burn the stubble of wheat-fields after the harvest; and if this measure be resorted to at a very dry time in the autumn, probably some of the worms would be destroyed by it. But, so far as I have observed, they uniformly lie here in situations where they are surrounded with some degree of moisture, under damp and mouldy clusters of straw and stubble, or slightly within the surface of the ground. It would, therefore, only be those straggling individuals that were not in their usual haunts, that the transient heat caused by such a burning would reach. Would a turning over of the field with the plow bury them to such a depth, that they would fail of finding their way to the surface again? This is an important inquiry. It is very probable that the larva can work its way to the surface, from a greater depth than what the pupa can. Direct experiment only can determine accurately at what depth the insect, in both these stages, must be buried in order to destroy it. No information of any value can, therefore, be given upon this point, until such experiments are made.

Plate 5

Engraved for the American Quarterly Journal of Agriculture

DESCRIPTION OF THE CLEAR-WINGED WHEAT-FLY.

CECIDOMYIA TRITICI.—*Kirby.*

The importance of full and accurate descriptions of every one of the several parts of a natural object, in order that it may be identified with certainty, is strikingly illustrated in the present species. For some years it has been *supposed* to be identical with the English wheat-fly; but those who are aware of the large number of both plants and animals in Europe, that have analogous representatives in this country so closely resembling them as to have been in many instances for a long time considered identical even by accurate and experienced observers, could not but entertain doubts upon this point; and with the fifteen or twenty characters of this insect which could be gathered from different sources, I could still only say that our wheat-fly was *probably* the *Tritici* of Mr. Kirby, some of its prominent peculiarities seeming even to conflict with the descriptions given of that species. For instance, all that we could gather respecting the form of the joints of the antennæ, was, that they were "*moniliform*;" and Messrs. Kirby and Spence, in their "Introduction to Entomology," define this term to mean "oval or globular joints, like a necklace of beads." Now the joints of the antennæ in our insect are oblong, and each has a marked contraction in its middle, thus approaching to an hourglass shape, a form the very reverse of "oval" or "globular." It was not until I saw the excellent figures and descriptions of Mr. Curtis, that I became well assured that our species was identical with the European.

The common reader will get the most clear and definite idea of the appearance of the wheat-fly, by being told that it looks almost exactly like the wheat-worm with wings and legs added to it. These members, however, are so very small as to be scarcely recognized by the naked eyes, except when they are fixed intently upon the object.

The HEAD of the *female* Cecidomyia Tritici (Plate, fig. 1) is of an orbiculate or flattened-globular form, with the *eyes* forming its periphery. These are large, occupying full two-thirds of the entire head. They are of a deep black color, and are separated from each other on the top of the head only by a slight and almost imperceptible cleft, so that when viewed in front they appear like a continuous broad

black band surrounding the head, and interrrupted only below at the mouth, thus resembling a horse shoe in their figure. The *face* is pale yellow. In its centre, and contiguous to each other, are two pale yellow tubercles or spherical eminences, more or less conspicuous, on which the antennæ are inserted, and which are by some regarded as forming a joint of these organs, in addition to the number commonly stated. The *antennæ* are of a deep brown or black color, less intense than the eyes. They are of about the same length as the body, and composed of twelve joints. Each joint (Plate, fig. *h*) is commonly oblong, with a marked contraction in its middle, a shape which is sometimes designated as "coarctiform," and is surrounded with a whirl or row of hairs near its base, and another near its apex.* The joints are ordinarily about thrice as long as they are broad, their diameter being but little less than that of the legs. They are connected together by a slender thread intervening between each joint, and about a fourth as long as the joints themselves. The two *palpi* are pale yellow, and clothed with shortish hairs: each is composed of four oval joints; the one terminal being longer, but of the same diameter with the preceding.

The THORAX is of a pale yellow color; its upper side commonly tinged with fulvous brown, which sometimes, though rarely, forms three vittæ or longitudinal spots forward to the middle. It is of an ovate form, its greatest breadth being immediately back of the wing sockets. Its vertical diameter much exceeds the transverse, as is common in most species of *Tipulidæ*, the breast jutting down far below the level of the head and abdomen. The *poisers* are oval, honey-yellow, their pedicels with a strong notch in the middle of their anterior sides.

The ABDOMEN throughout is of an orange color, more inclining to red than to yellow. Its broadest part scarcely equals the thorax in

*Not unfrequently, however, singular anomalies occur in these joints. Thus in some the contraction will be so considerable as to cause the segment to appear like two globular joints slightly but distinctly separate from each other; whilst other segments *of the same series* are abbreviated and dilated, the usual contraction thus becoming obsolete, and the joint taking on a short cylindrical form. It would thus seem as though we, in the female, met with twenty-four joints of the male attennæ in a modified or imperfectly developed condition; that what appears as a single oblong coaretiform joint, is in reality two joints united. This would give but a single whirl of hairs to each joint, as is common in most of the species of this genus.

diameter. It is of an ovate form, often conspicuously attenuated towards its tip, (as represented, fig. 1.) whence the two valvular sheaths of the ovipositor are seen more or less exserted, and sometimes the apex of the ovipositor itself projecting between them like a fine slender thread. According to Mr. Curtis, by a slight pressure on the abdomen of the living insect, the ovipositor (Plate fig. *f*) can be made to protrude, and may then be drawn out to nearly thrice the length of the body.

The WINGS are hyaline and colorless, appearing like thin plates of glass or mica, but reflecting the tints of the rainbow, particularly the violet, when viewed in certain directions. Their margins are densely ciliated with longish hairs, and their surface is covered with minute pubescence. The mediastinal or *submarginal nerve* is but slightly distant from the costal (marginal), and becomes confluent with it rather forward of the middle of the exterior margin. From its middle, it sends a small connecting nerve backward to the postcostal. The *postcostal*, which is the most conspicuous nervure of the wing, runs direct, or with but an insensible curve, to the tip of the wing. The *medial* is straight, and attains the inner margin at about three-fourths of the distance from the base to the apex of the wing. The *anal* runs nearly parallel with the inner margin, and, with a very sudden curve from its direct course, joins the margin near its middle. It gives off an obscure branch at its angle, which curves outwards and backwards, joining the medial, or rather, seeming (if the wing be moved so as to give a slightly different incidence to the light) to be continued onward, parallel with and contiguous to the medial nerve, till it attains the margin of the wing. The medial and anal nerves are very slender, and are often invisible, except in a particular reflection of the light. The former, especially, can seldom be distinctly traced, except towards its termination. These details of the neuration of the wing apply equally well to all the species of Cecidomyia that have fallen under my observation, save only that they are more distinctly traced in the others, particularly the larger species. At rest (Plate fig. 6,) the wings are laid one upon the other, reposing horizontally upon the back of the abdomen, and reaching about a fourth of their length beyond it.

The LEGS are whitish or very pale yellow, long and slender, of a cylindrical form, and of nearly the same diameter through their entire

length. The coxæ (small joints by which the femurs are connected with the sternum), as they are directed more or less backwards, vary the point from which the legs seem to arise in different specimens when viewed from above. The femurs, tibiæ, and second joint of the tarsi, are all of about the same length. The third, fourth, and fifth joints of the tarsi (Plate fig. *g*), are successively shorter; whilst the basal joint is the shortest of all, its length little exceeding its diameter.

All parts of the body and limbs are clothed with minute, slender, longish hairs.

The MALE differs so remarkably in its aspect from the female, and is moreover so rare an insect, that it has generally escaped the researches of observers. It would appear from Mr. Curtis's paper, that Meigen is the only one who has identified and given a description of this sex; and I should distrust my having any specimens of it, but that one of the flies hatched from the larvæ already spoken of as gathered in a wheat-field early in the spring, is a male (Plate, fig. 4); and a few of my other specimens manifestly coincide with this. In these the *antennæ* are at least double the length of the body, and composed of twenty-four joints of a very exact globular form (Plate, fig. *e*.); each joint encircled with a single row of hairs, and separated widely from its fellows, the thread between being of about twice the length of the joint itself. The *abdomen*, instead of being an ovate form, as in the female, is broadest at the base, and thence tapers gradually, though slightly, towards the apex; the terminal segment, however, being broader than the one or two preceding it, and of a reniform shape, with the lobes directed backwards. The male is also somewhat smaller in size: in all its other marks, it appears to correspond with the female.

Among the hosts of specimens of the female that may be met with, there will occur considerable variations in size, color, and some minor particulars. The common length, to the tip of the abdomen, is the twelfth of an inch, or slightly under this; yet I have measured recent specimens from the wheat-field, that were but half this size. The color seems to be more uniform in specimens taken from the wheat-field, than in those procured in other situations. It is of a lively orange-red, particularly upon the abdomen, where the color is most observed; but varies from that to amber or honey-yellow, lemon-yellow, and even to a cream-color. The specimens already spoken of as having

been raised in dried earth; are all quite pale; and it would hence appear as though these lighter colored varieties were caused by unfavorable circumstances in which the insect had been placed when in its larva state.

THE SPOTTED WINGED WHEAT-FLY.

CECIDOMYIA CEREALIS.

Another species of *Cecidomyia* (Plate fig. 2,) as the reader has been already informed, is frequently met with, associated with the *Tritici* in fields of wheat. It is closely allied to the latter in form and coloring, having like it an orange colored body, hyaline wings, pale yellowish-white legs, and twelve joints to the antennæ, identical with those of the *Tritici* in their details. It is, however, readily distinguished from the *Tritici*, as well as from all the other species of this genus, with only two or three exceptions, by having spots upon its wings. (Plate, fig. *k*.) These spots are so conspicuous as to be recognized by the naked eye, even when the insect is flying. They are of a pale black or smoky color, and six in number on each wing. Two, and these the most conspicuous from being commonly of a deeper tint, are placed upon the outer margin; one being at the tip of the submarginal nerve, where it unites with the costal; the other, half way between this and the apex of the wing. Both these spots reach across the costal cell, and often slightly into the externo-medial. Another spot occupies the apex of the wing, at the tip of the post-costal nerve. Two others are based upon the inner margin, one at the apex of the middle nerve and mostly in the inner middle cell, the other occupying the middle of the anal cell, but nowhere touching the anal nerve. The sixth spot is upon the disk of the wing, mostly in the outer middle cell, and is sometimes confluent more or less with one or more of the marginal spots. The nerves, when traversing these spots, are of a deeper black color than in other parts of their course, as are also the hairs which proceed from them into the fringed border of the wing. These spots are formed by a pigment in the membrane of the wing, the fine pubescence upon the surface being no more dense here than upon the other parts. The species under consideration is farther distinguished from the *Tritici*, by invariably having the base of the abdomen, on its upper side, of a brown or blackish color. The last joints of the

feet, moreover, are black in this species, and there is a broad black band at the base of the anterior tarsi.

The *males* have the antennæ composed of twenty-four joints, each encircled as usual with a row of hairs. These joints approach a globular form, but have, in common with those of the males of several other of our species, this striking peculiarity, namely, that through the whole series, though preserving the same diameter, they are alternately shorter and longer; twelve being compressed-globular or double-convex, and between each of these a very short cylindrical joint with convex ends.

This species is closely related to the *ornata* of Say (*Appendix to Long's Expedition*, p. 357), but is readily distinguished from that by its blackish antennæ, the color of which contrasts strongly with that of the legs; by the greater number of spots on its wings, and these spots not being "occasioned by the greater density of the hair of the surface in those parts." In the latter character it also differs from the *pictipennis* of Meigen, as described by Macquart; as also in not having the spots forming bands across the wings. If any description of the *maculipennis* of Stephens, in his catalogue of British insects, has ever been published, I have not met with it. That this species, however, exists abroad, is highly probable, from the fact that the specimens reared from wheat-worms by Mr. Markwick had "spotted and transparent wings," as he describes them, or clouds" as they were termed by Mr. Marsham. Mr. Curtis calls attention to this fact respecting these specimens, apparently from a suspicion thus excited that another species existed. He says, "I am particular in noticing this, because the wings of Mr. Kirby's *C. Tritici* are not spotted, nor are any individuals that I have seen; and excepting the *C. pictipennis*, which is larger, I know of no species of the genus with spotted wings."

The species under consideration, may appropriately be named and characterized as follows:

Cecidomyia cerealis. Pale orange; tips of tarsi black; wings hyaline, with six dusky spots, two only based on the inner margin; apex of anal nervure immaculate. Length 0.05.

Specimens have been taken almost weekly, from the middle of June till the fore part of September, in fields of flowering wheat, among the grass of plats contiguous to dwellings, and upon the windows of houses. I do not doubt but its habits are very similar

and perhaps identical with those of the *Tritici*, and that in proportion to its numbers it is equally destructive. The investigations of another year, may, I hope, enable me to furnish something more definite upon this most interesting subject.

SPECIES RESEMBLING THE WHEAT-FLIES.

CECIDOMYIA CALIPTERA: C. THORACICA: C. TERGATA.

We have what appear to be several species of Cecidomyides, allied to our wheat-flies in size, in the number and form of the joints of the antennæ, and more or less in the colors of their bodies. Among objects so exceedingly minute, and so closely related to each other, a most patient and critical study of a large collection of specimens, in their recent as well as their dried state, is indispensable, in order to trace out with accuracy and define with precision each of these species. Perplexity and confusion will be the inevitable result of a hasty or superficial performance of a work of this character. It is hence that I shall at present venture to name and characterize but three of these species, whose marks are so evident and distinct as to render their recognition comparatively easy, yet whose colors are so analogous to those of the two insects above described that they would be confounded with them by ordinary observers, unless aware of their distinctive marks. I am only acquainted with these species in their perfect state.

From the middle of July to the first of September, a number of specimens were taken, of a species intimately allied to the spotted-winged wheat-fly. The body, however, is more deeply colored, being to a greater or less degree tinged with red, and the thorax both above and on the sides is of a fulvous-brown shade. It may be readily distinguished from the *cerealis* by its tarsi, the tips of which are of the same pale yellowish hue as the legs, and yet more readily by the spots on its wings, which are seven in number (Plate, fig. *l*). These spots are similarly placed with those of the wheat-fly, except on the inner margin of the wing, where the present species has three in number. One of these is situated on the apex of the middle nerve, a second one on the apex of the anal nerve, and a third at the axilla or base of the anal cell. These spots, though smaller, are equally conspicuous with those of the *cerealis*, being commonly of a deeper shade than those possess which are based on

the exterior margin. The two species may at once be discriminated from each other by observing the space about the apex of the anal nerve; this is perfectly hyaline in the wheat-fly, and clouded in the species under consideration, to which the following name and essential marks may be assigned:

Cecidamyia caliptera. Orange-red; tarsi whitish to their tips; wings hyaline, with seven dusky spots, three based on the inner margin, the middle one being on the apex of the anal nerve.
Length 0.05.

A few specimens occurred to my notice about the middle of the month of August, having the abdomen more tinged with red than in the wheat-flies, but commonly fading, when preserved, to a flesh-color or dull yellow; the thorax brown or blackish above, its sides dull yellow; legs blackish except at their bases, and poisers of the same hue; wings dusky, with their nervures more distinctly marked than in the wheat-flies. I would propose for this species a name alluding to the contrast between the color of the thorax and of the abdomen, in a dorsal view of the insect (Plate, fig. 8).

Cecidamyia thoracica. Red: thorax above blackish-brown: legs and poisers blackish: wings dusky.
Length 0.05.

A much more abundant species, and very closely related to the preceding, occurs from the last of July till the middle of September, and perhaps later. Its legs are dusky, but not of so deep a tint as those of the *thoracica*, from which, moreover, it is readily distinguished by having invariably a fulvous-brown or blackish spot at the base of the abdomen on its upper side. The base and sides of the thorax are of the same color with the abdomen, namely, red, or in old specimens dull pale yellow; the upper side, forward of the scutel, being brown. This species (Plate, fig. 5), may be named and characterized as follows:

Cecidomyia tergata. Red: thorax anteriorly and spot at base of tergum brown: wings, legs and poisers dusky.
Length about 0.06.

Each of the preceding appear to be quite distinct from any of the European species that have been described.

The history of the insect which has now been considered, presents some very singular and deeply interesting traits. Far back in the vista of years we see it a powerful depredator: anon it sinks into

obscurity and becomes wholly forgotten. After a lapse of time, a person observes a minute worm in the ears of wheat which he apprehends will do mischief. Another sees it, and for a time is persuaded that it does his crops no damage whatever. A student has his curiosity so far excited that he closely investigates its operations, and records the results of his observations, estimating that in one field twenty bushels of grain, probably a fifteenth part of the crop, had been destroyed. How little is there here to excite alarm. How many fortuitous circumstances annually occur which cause us greater losses. And now, year after year rolls away, till one generation of the human race has nearly passed out of existence, yet nothing, nothing further is heard of this matter. That student bids fair to sink into the grave, perhaps with the apprehension that posterity will pronounce his early labors tinged with the exaggerations of a juvenile enthusiasm. But lo, a new epoch unexpectedly opens before us. Suddenly bursting from its long obscurity, it rushes forth with resistless vigor. It menaces the population of entire districts with bankruptcy, and even threatens to wrest from man his "staff of life." More marvellous still, it overleaps the ocean's vast expanse, it plants itself far in the interior of another continent, and there runs a career surpassing in the severity of its havoc all that had been known of it in its native haunts. And what is this potent enemy? A diminutive gnat, seemingly too trivial to merit a moment's notice, too impotent to excite an uneasy thought!—a tiny midge, so puny as to flee from the light of day, so fragile as to be dismembered by a breath, or crushed by the drop of a pin! Yet man, the vaunted "lord of creation" stands dismayed and powerless before it. He sees his property wasted to the amount of millions, yet is incapable of resorting to any measure to mitigate the severity of its devastations, or of erecting the slightest barrier to check it in its triumphant progress!

We close this account, then, with the hope that what has now been written may be of some avail, not merely in giving the agriculturist a more intimate knowledge of one of his greatest enemies, but also in enabling the general reader more duly to appreciate the vast value of a branch of natural science but slightly esteemed and but little pursued in this country. Since there is not one of our cultivated plants, not one of our forest or fruit trees, not one of our domesticated animals but is frequently attacked and liable to be de-

stroyed by one or more of that myriad of beings which belong to the insect races of our land, how very important is it that the habits of each one of these should be fully and accurately investigated. Mayhap many of them, minute though they are, and apparently feeble and innoxious, may one day, like the wheat-fly, become powerful despoilers of our property and inflict upon us most severe calamities. It is only by a familiar acquaintance with them that we can hope to avert from us such disasters.

Salem, N. Y., Feb. 6, 1846.

DESCRIPTION OF THE PLATE.

Fig. 1. Clear-winged wheat-fly, *Cecidomyia Tritici*.

Fig. 2. Spotted-winged wheat-fly, *Cecidomyia cerealis*.

Fig. 3. *Cecidomyia thoracica*.

Fig. 4. Male of the clear-winged wheat-fly.

Fig. 5. *Cecidomyia tergata*.

Fig. 6. Wheat-fly at rest, with its wings in their natural position.

Fig. *a*. Kernel of wheat, its chaff parted down to show the worms in their usual situation.

Fig. *b*. A mature worm or larva, highly magnified.

Fig. *c*. Wheat-head, with the chaff at * * * as bent down by the yellow-bird in feeding upon the worms, the kernels remaining at ††.

Fig. *e*. Part of a male antenna.

Fig. *f*. Tip of the abdomen, with the ovipositor drawn out (from Curtis].

Fig. *g*. Foot of a wheat-fly, highly magnified to show its several joints.

Fig. *h*. Part of a female antenna.

Fig. *i*. Wheat-fly in its natural size.

Fig. *k*. Magnified wing of *Cecidomyia cerealis*.

Fig. *l*. Magnified wing of *Cecidomyia caliptera*.

Trans. N.Y. State Agr. Soc. for 1846.

I hereby certify, that I have used this season, some of the chemical guano, manufactured by D. B. Stockholm, Esq., on potatoes and cucumbers with decided success. Both were planted the fifth day of May, and by the fourth of July, I have potatoes on the parts manured, of good size and fit to boil; whilst the next row of potatoes which was not manured with the guano, have none larger than peas; my cucumbers were also large enough for the table by the fourth of July. The vines grew vigorously; were of a dark color; their stems were the largest I ever saw, they lasted long, and yielded an abundance of fruit. My garden adjoins that of Mr. Stockholm, where he has also been making experiments with his guano, and I have noticed them particularly at his request.

Corn manured with it liberally, planted the last of May, although it was injured by the drought, grew vigorously. It is now well eared and out of danger of frost.

Some corn planted the first of July, to which the manure was applied, has also grown well, although hoed but once; and now has on it ears nearly fit to roast. The beets, carrots and melons have also grown luxuriantly, although in consequence of the frequent absence of Mr. Stockholm from the village during the summer, the garden has been neglected, and is overrun with weeds and grass. I am well satisfied that the vegetables of his garden have not been better, if as well attended as the corn of the farm grown in the field. This was done intentionally by Mr. S. in order that he might ascertain what would be the probable effect of the manure upon the crops of the farmer. The garden of Mr. S. had no other manure this season; but the guano was liberally applied twice to the corn. It is of full height, its color is dark, and for the kind of corn, (Tuscarora and sweet corn) the ears are numerous and of good size. It is planted in hills about $2\frac{1}{2}$ feet apart.

I have closely observed with much interest, the effect of this new manure, and have no hesitation in saying, that the chemical guano, discovered by Mr. Stockholm, is the greatest and best manure I ever saw.

From the corn planted the first of July, was gathered on the 11th of September, a mess of corn fit to boil; and if we have no frost before the 16th it will ripen.

Ithaca, Aug. 29, 1846. B. GIFFORD.

THE HESSIAN FLY:

ITS HISTORY, CHARACTER, TRANSFORMATIONS, AND HABITS.

By Asa Fitch, M. D.

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The insect which we are about to consider, has for a long period been, at times, a severe scourge, in every district of our country. It is more formidable to us, says Dr. B. S. Barton, than would be an army of twenty thousand Hessians, or of any other twenty thousand hirelings, supplied with all the implements of war. Hence it has forced itself prominently to the notice both of agriculturists and men of science. No other insect of the tens of thousands that teem in our land, has received a tithe of the attention, or been chronicled with a tithe of the voluminousness that has been assigned to this species. Our scientific journals, our agricultural magazines, and our common newspapers, have each accorded to it a conspicuous place in their columns. As may well be supposed, almost every point in its history, has by one and another of its observers, been closely investigated, and laid before the public. Very little that is new, can, therefore, at this day be embodied in an account of this species. The most that an observer can accomplish, is to add his testimony in confirmation of facts that have been already announced. The most that a writer can aim at, is to gather the various papers that are scattered through volumes sufficiently numerous of themselves to form a library, sift from them whatever they contain of importance, and arrange the facts thus acquired, into a connected and symmetrical memoir. Such is the object of the present essay; to carefully review the various accounts that have been hitherto published, extract from each the items of value which it contains, compare these with personal observations made under favorable circumstances during the past twelve months, and with the materials thus acquired, write out a history of this species, more

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ample in its details than any that has been hitherto attempted, and containing a complete summary of all that is known of this insect down to the present day.

It is a European Insect.

For several years subsequent to the first appearance of the Hessian fly in this country, it was universally believed to have been derived from abroad. When, however, the severe devastations which it was committing upon this continent became known in Europe, public attention was so strongly excited as to lead to an extensive and thorough search for the insect there. The result of this investigation, as given by Sir Joseph Banks in his report to the British government, was, that "no such insect could be found to exist in Germany or any other part of Europe." It was in consequence, received as an established fact, and assented to on all hands, that this was an exclusively American species. Of late years, however, new light has been shed upon this subject; and we now proceed to detail the evidence which induces us to believe that the Hessian fly is indeed a European insect.

It would appear that this insect, or one identical with it in its characters and habits, did exist, and commit severe ravages in Europe, long anterior to its appearance in America. In Duhamel's *Practical Treatise of Husbandry*, (London, 1759, 4to. p. 90,) and also in his *Elements of Agriculture*, (Lond. 1764, 8vo., vol. i., p. 269,) after alluding to a worm in the root of oats, he says, "I suspect it to have been an insect of this kind that *destroyed so much wheat* in the neighborhood of Geneva, and which M. de Chateauvieux describes thus: 'Our wheat in the present month of May, 1755, sustained a loss, which even that cultivated according to the new husbandry has not escaped. A number of *small white worms* have been found on it, *which*, after a time, *turn to a chestnut color;* they place themselves *betwixt the leaves*, and gnaw the stalk; they are commonly found *betwixt the first joint and the root;* the stalks on which they fix are immediately at a stand; they *grow yellow and wither*. The same accident happened in 1732: these insects appeared about the middle of May, and did so much damage that the crops were scarcely worth anything.'" This account, though per-

haps too brief and imperfect to justify a decided opinion, corresponds much more exactly with the Hessian fly, than with any other insect of which we have any knowledge. Acquainted with it, as our men of science in this country were, we are surprised that they so readily and unanimously succumbed to the sentiment that the species was indigenous to America.

In 1788, as we are informed in the *Encyclopædia Britannica*, (art. Hessian fly, §5,) the Duke of Dorset addressed a letter to the Royal Society of Agriculture in France, inquiring if the Hessian fly existed in that country. "The report of the society was accompanied with a drawing of two insects, one of which was supposed to be the caterpillar of the Hessian fly, from its attacking the wheat only when in the herb; beginning its ravages in autumn, reappearing in the spring, and undergoing the same metamorphoses." From an obscurity in the phraseology of the subsequent paragraph, and a reference therein to the memoirs of the Stockholm Academy, it would seem that the society regarded the Hessian fly as identical with the *Chlorops pumilionis* (Bjerkander) Meig.—a fly whose larva lives at the base of the stems of the wheat and rye, and which a few years before had been extremely injurious to these crops in Sweden. A doubt is therefore excited, whether the French insect might not have been this latter species. But, as the society deemed their insect to be the Hessian fly, it is somewhat singular that its history was not investigated and distinctly recorded, before the announcement was so confidently put forth, that this species could not be found in Europe.

But, more recently, clearer evidence upon this point is furnished us. Mr. Herrick, in his valuable article in *Silliman's Journal*, (vol. xli. p. 154,) informs us, that Mr. J. D. Dana, who had been much associated with him in making a thorough investigation of the habits of the Hessian fly and its parasites, being on a voyage in the Mediterranean, "on the 13th of March, 1834, and subsequently, collected several larvæ and pupæ, from wheat plants growing in a field, on the Island of Minorca. From these pupæ, were evolved on the 16th of March, 1834, two individuals of an insect, which his recollections (aided by a drawing of the Hessian fly with which he was provided), enabled him to pronounce to be the *Cecidomyia*

destructor. More of the perfect insects were evolved in the course of the month, one of which deposited eggs like those of the Hessian fly. In letters, dated Mahon, April 8 and 21, Mr. D. sent me five of the insects, and several of the pupæ. They arrived in safety, and after a careful examination, I saw no good reason to doubt the identity of this insect with the Hessian fly. The Mahonese asserted that the insect had been there from time immemorial, and often did great damage both there and in Spain." And further, "on the 28th of April, 1834, Mr. D. collected from a wheat field just without the walls of Toulon, in France, several pupæ and one larva like those before obtained. On the 4th of June, 1834, he obtained similar pupæ from a wheat field near Naples." We doubt whether there was living, at that day, two persons better qualified to determine the identity of these insects with the Hessian fly, than Messrs. Herrick and Dana. Testimony from such a source needs no comment.

Finally, the year previous to that in which Mr. Dana made the above examination, it appears that the wheat crops in some parts of Germany, were seriously injured by an insect which was generally regarded as the Hessian fly. M. Köllar, of Vienna, in his treatise on injurious insects, (London, 1840, p. 119,) relates that in the autumn of 1843, complaints were made that the wheat on the estates of his imperial highness, the Archduke Charles, at Altenburg, in Hungary, had been considerably injured by an unknown insect, of which the following account was forwarded to the archdueal office. "Till the end of May, the wheat was in excellent condition, but about the commencement of June, the ears began to hang down, and the stem to bend, and in a few days patches appeared in different parts of the fields which were of rather poorer soil than the others, with the plants entangled and matted together, as though lodged by heavy rains. . . . . More than two-thirds of the straw was lodged in less than a week; and the heavy rains which fell in the latter half of June, so fully completed the work of destruction, that the wheat fields looked *as if herds of cattle had gone over them*. The cause of this damage was sought for, and we soon discovered at the crown of the root of each of the wheat plants, or at the first joint, within the sheath of the leaf, whole clusters of

pupæ of an unknown insect. Those plants, the roots of which had been attacked, died off; and the spot to which the insects had fastened themselves on the still soft straw within the sheath of the leaf, was found to be brown, withered, and tough, yet *without any apparent wound.* The straw which had become lodged, produced small ears, with few and imperfect grains, which ripened with difficulty, and the straw was twisted, and of a very inferior quality."

Nearly a hundred miles south-west of Saxe-Altenburgh, a similar account is simultaneously given by Baron Von Meninger, agricultural director of the Duke of Saxe-Coburg. According to his report, "In the fields of Weikendorf, and other neighboring localities, caterpillars were found which had devastated whole fields. These caterpillars had their first abode near the ground, in the first joint of the straw, where they were found in whole families, in a sort of nest. The largest were about the length of two lines. Their color was pale green, with a small black dot above. . . . . The straw became dry at the first joint, and fell over or leaned on its neighbor. The upper part of the straw received its nourishment from the atmosphere alone, and the ears formed: but they continued in a sickly condition, and could only produce small, shrivelled grains. The life of the caterpillars (their duration as naked worms?) appeared to be from about twenty-four to thirty days. As the straw ripened, the insects changed their color into a brownish hue, shrivelled up, and finally disappeared."

M. Köllar, who seems to have known nothing of the American history of this insect beyond what he gathered from Mr. Say's brief account, obtained some of the diseased straw from Germany, in which, he says, "many of the brown pupæ were found. I opened the pupa-case, and was able to determine with great probability, partly from the form of the pupa, and partly from the unchanged caterpillar in the pupa-case, that it must be a small fly. I only ascertained this from the minute description and drawing of the insect from Mr. Thomas Say, in a North American journal, in which a stem of wheat, with the pupa within it, is exactly represented as I have seen our wheat."

Mr. Westwood, in a note appended to this account, says, it is perhaps questionable whether the species, of which the above de-

tails are given by M. Kollar, is identical with Say's *Cecidomyia destructor*. He even intimates a doubt whether the European species is a Cecidomyia, for, from all that had been observed, this genus in its pupa state, is naked, like the other Tipulidæ, and not enclosed in a case. Having himself received specimens from Dr. Hammerschmidt of Vienna, and still in the straw near the roots, he found the insect "enclosed in a leathery case," on opening which, he discovered the *larva* shrivelled up and dead. Now this nice point, so particularly noted, and so strikingly showing the acuteness of discrimination possessed by that eminent naturalist, we think must dispel the last lingering doubt as to the identity of the American and European insects. As will fully appear in a subsequent part of this paper, the Hessian fly presents this singular anomaly, that its pupa is coarctate, or enclosed in a case like those of the *other families* of dipterous insects, but *unlike* all the pupæ of the Cecidomyians and other Tipulidæ that have been hitherto observed! The very fact, therefore, which leads Mr. Westwood to suspect the European insect is not a Cecidomyia, all but demonstrates that *it is the Hessian fly!*

Its Introduction into America.

The existence of the Hessian fly in Europe being premised, so many circumstances conspire to render it probable that it was introduced into this country in the mode originally supposed, that scarcely a doubt can now be entertained upon this point.

When the habits and transformations of the insect itself are considered, it will be perceived that these interpose great obstacles to its being transported across the Atlantic, at a period when two months or more were required for the voyage. Its passing through two generations in a year, makes its continuance in any one stage of its existence comparatively brief. The first of these generations occupies about seven months, from October to April inclusive. This generation is nurtured at the roots of the young plants, and there is no probability that any of these plants would be taken up, so that the insect could thus be conveyed away. The second generation is nurtured in the lower joints of the straw. The worm attains maturity in May, becomes a dormant "flax seed" in June, continues in

this state till August, when the fly comes out to deposit its eggs in September. Though most of these flax seeds remain in the stubble when the grain is harvested, numbers of them are so high in the straw, as to be gathered with it. But they are so firmly imbedded in the straw, and enveloped within the sheathing base of the leaf, that it must be rare that any of them are detached by the flail in threshing, so as to find their way among the grain, and thus with it be carried to a distance. As the flax seeds moreover, evolve the perfect insect in August, it must be equally rare that a solitary fly comes from the straw after that date. These facts clearly show that there is *but one mode*, and *but one month in the year*, in which this insect could probably have been conveyed to this country at that time, to wit, *in straw* landed upon our coast *in August*. If landed at a later date, the flies would have completed their transformations, and made their escape, or perished in their confinement; if earlier, there is no probability that the straw could have been of the growth of that year, consequently it would have contained no live insects. Our present knowledge of the habits of this insect thus affords us a singularly accurate test, for ascertaining the truth of the original theory respecting the mode in which it was introduced.

And how do the facts furnished us by the military history of those times, accord with what we have seen to be almost essential contingencies to the importation of this insect? Early in July of the year 1776, General Sir William Howe arrived on the New-York coast from Halifax, with the troops which had evacuated Boston, and debarked upon that part of Staten Island which lies within the Narrows—one of the reasons which induced him to make this part of the continent the central point of his operations being, that "Long Island was very fertile in wheat and all other corns, and was deemed almost equal alone to the maintenance of an army," (*Bisset's Hist. Geo. III*). We are informed in *Marshall's Life of Washington*, (vol. ii. p. 424,) under the date of *August*, 1776, that "the reinforcements to the British army were *now* arriving daily from Europe." Lord Howe's strength was hereby augmented to twenty-four thousand men, about half of whom (as is probable from the statement, page 416,) were newly arrived "Hessians and Waldeckers." The most of these were from Hesse Cassel, a district

but about a hundred miles distant from Saxe-Coburg and Saxe-Altenburg, where, as we have already seen, the same insect did much damage to the wheat crops in 1833. And again, under the date of August 25, (p. 437,) it is stated, that "*on this day*, General De Heister landed with two brigades of Hessians. The next day he took post at Flatbush," on Long Island, about six miles distant from the main encampment on Staten Island.

In juxtaposition with this account, let us now place the statement of one, who, Sir John Temple, the British Consul General at New-York tells us, "had been more curious with respect to this insect, than any other person with whom he was acquainted." Says Col. Morgan, (*Encyc. Britann.*) "The Hessian fly was first introduced into America by means of some straw made use of in package, or otherwise, landed on Long Island, at an early period of the late war; and its first appearance was in the neighborhood of Sir William Howe's debarkation, and at Flatbush." So many circumstances concur to evince the truth of the account here given by Col. Morgan, to its very letter, that we think no one will hereafter hesitate to give it full credence.

We have searched in vain for the date of the embarkation of the Hessian troops, or the number of days occupied by them in crossing the ocean. It is possible they may all have left Europe anterior to the harvest. But in Germany, as in this country, as is shown by M. Köllar's statement, the infested straw becomes broken and tangled, and turns yellow, early in June. Had a company of soldiers needed straw for package, no objections would have been made to their going into a field of this kind, and with a scythe, gathering what they required, weeks before the usual time of harvest.

We have no where met with but one statement, which goes directly to prove that this insect is indigenous to this country, or existed here anterior to the arrival of the Hessian troops. The late Judge Hickock of Lansingburgh, N. Y., in a communication to the Board of Agriculture in the year 1823, and published in their *Memoirs*, (vol. ii. page 169,) says, "a respectable and observing farmer of this town, Col. James Brookins, has informed me, that on his first hearing of the alarm on Long Island, in the year 1786, (doubtless

1776 is intended,) and many years before its ravages were complained of in this part of the country, he detected the same insect, upon examining the wheat growing on his farm in this town." If this insect, observed by Col. Brookins in 1776, was the genuine *destructor*, it is a little singular that to betray its real character, it patiently awaited some fourteen years, to be reinforced by its kindred from Long Island, who reached it by regular advances made year after year—that on their arrival, and not till then, it acquired the skill and courage to go forth and lay waste the crops through all this section of country for several successive years. The strong probability is, that it was some other insect which was found by Col. Brookins.

Its Civil History and Bibliography.

We now proceed to adduce such facts as we have been able to collect, respecting the devastation of this insect in different years, or in other words, to trace out with as much precision as the data before us will enable us to do, its civil history, from the period of its first appearance, down to the present time; and in connection with this, to notice the different memoirs and other papers of value that have been published respecting it, so far as we have had an opportunity of becoming acquainted with them.

Anterior to the revolutionary war, the Hessian fly was unknown in this country. No allusion to an insect of this kind has been found in any American work, or in the journal of any foreign traveller, nor since its appearance has it been intimated that any of our citizens had ever observed it previous to that time.

All accounts concur in stating that its first appearance was upon Staten Island, and the west end of Long Island. There is some discrepancy between different writers, as to the particular year in which it was first observed. Dr. Mitchell states (*Encyc. Britann.*) that "it was first discovered in the year 1776." The ravages of the insect, however, are so much more conspicuous and liable to attract attention from the broken and tangled condition of the straw as it approaches maturity in June, than they are when a portion of the young shoots are discolored and withered in October, that there can be little doubt but it would first be observed at the

former period. Had Dr. Mitchell, therefore, received definite information upon this point, it would doubtless have been coupled with the statement, that it was noticed at or before the harvest in that year, and consequently anterior to the arrival of the Hessian troops—which fact, he, confident as he was that this was an indigenous insect, would not have failed triumphantly to have stated. It is hence believed, that Dr. M. has assumed this date, from the current report that this insect was introduced by the Hessian soldiers, knowing this to have been the year of their arrival.

From the "flax seeds" casually lodged in the imported straw, only a few flies would probably be evolved, to deposit their eggs upon the young wheat in the autumn of 1776; nor would these have multiplied to such an extent in the following spring as to attract attention at the time of harvest. But, increasing with each successive brood, by the harvest of the following year, 1778, we might anticipate its being observed, and by a year thereafter, it would become so numerous that its real character would no longer be in doubt. And in accordance with this, we are informed by Colonel Morgan, that "the fly made its first appearance in 1778;" and Mr. Clark, who in 1787 went to Long Island expressly to gather authentic information respecting this insect, says in his report, "on the best inquiry I could make, during my stay there, I satisfied myself in the following particulars, namely: first, that the Hessian fly made its first appearance there about the year 1779, so as to injure, and in some cases to destroy their crops of wheat." An anonymous writer in *Carey's Museum*, (vol. i, p. 143,) gives the same year as about the period of its discovery.

We therefore regard the year 1779 as most probably the date when its ravages actually commenced. The crops of wheat were severely injured or wholly destroyed by it in Kings and Richmond counties, during several of the following years; and each succeeding generation regularly enlarged the sphere of its devastations in every direction.

Quite early in its history, the important fact became accidentally discovered, that certain varieties of wheat are capable of withstanding its attacks. In the year 1781, a prize schooner loaded with wheat

was taken in the Delaware river, and carried into New-York, whence the cargo was sent to the mill of Isaac Underhill, near Flushing, Long Island, to be ground. Mr. Underhill's own crop of the previous year having been so entirely destroyed that he had no grain for seed, he took what he required for sowing from this cargo, and reaped therefrom upwards of twenty bushels per acre, whilst few of his neighbors for miles around had any to reap, so calamitous were the operations of the fly. To his praise be it recorded, he distributed his entire crop, in small quantities, and at a moderate price, among his neighbors, for seed; and all who made use of it were similarly successful. The "Underhill wheat" at once became noted, for effectually resisting the attacks of the fly, and for many years subsequently, as we shall have frequent occasion to notice, was eagerly sought for and successfully cultivated, where all other varieties of this grain failed. (*Vaux and Jacobs, Clark*).

In 1786, the fly reached Col. Morgan's farm, at Prospect, New-Jersey, about forty miles south-west of Staten Island. It was first observed in May, and by October was so increased, that some farmers in Middlesex, Somerset, and Monmouth counties were induced to plow up their young wheat and sow the fields to rye. Other fields, less injured, were allowed to remain until the succeeding spring, when their appearance was so disheartening, that many of them were plowed up and sowed with spring grain.

Eastward its progress would appear to have been much more rapid than towards the west and south, for this same year it had reached a hundred miles, nearly to the east end of Long Island, and was detected on Shelter Island. "It was first perceived a little before the harvest, and appeared to have come from the west end of Long Island, in a gradual progress of between twenty and thirty miles in a year. Before the harvest the species appeared to be few in number, but in the fall it was found to have greatly increased, and appeared in great numbers on the green wheat, and was observed to do most injury to that which had been most early sown." (*Havens, p.* 71).

Public attention was now becoming strongly turned towards this formidable foe. The New-York Society for promoting Useful Knowledge, issued an advertisement, requesting information respecting it. Two communications were soon received by them, and were directed to be inserted in the secular papers. These are the first published documents relating to the fly, that have occurred to our notice. They are copied into *Carey's American Museum* (Phila. vol. i. p. 324–326). One of them, dated New-York, September 1, 1786, gives a brief but pretty accurate account of the situation and habits of the insect, particularly in the fall and spring. The other, dated Hunterdon, New-Jersey, January 1, 1787, after hastily alluding to its habits, proposes as remedies, late sowing, on rich land; drawing elder bushes over the young plants; and passing over the wheat with a heavy roller to crush the worms.

In the *Pennsylvania Mercury* of June 8, 1787, is published a letter from Col. George Morgan, addressed to the Philadelphia Society for promoting Agriculture. He suggests the importance of their appointing some competent person to fully investigate the habits of the Hessian fly, and the remedies to protect from it, after the example of the Paris Academy of Sciences, which had commissioned Messrs. Duhamel and Tillet to enquire out the history of the Angoumois grain moth; he alludes to contradictory reports respecting the Underhill wheat, copies the paragraphs already given from M. Châteauvieux, as "answering in every respect to our Hessian fly," and gives an account of the ravages of the insect in his vicinity, and its habits so far as observed.

The *Mercury* of September 14th, contains another letter from Col. Morgan, correcting some inaccuracies in his previous communication, and giving some additional interesting items. He says, "those who are doubtful whether the fly is in their neighborhood, or cannot find the eggs or nits in the wheat, may satisfy themselves by opening their windows at night, and burning a candle in the room. The fly will enter in proportion to their numbers abroad. The first night after the commencement of the wheat harvest this season, they filled my dining room in such numbers, as to be exceedingly troublesome in the eating and drinking vessels. Without exaggeration, I may say, that a glass tumbler, from which beer

had been just drank at dinner, had five hundred flies in it, within a few minutes. The windows are filled with them when they desire to make their escape. They are very distinguishable from every other fly, by their (having) horns or whiskers."

Accompanying Col. Morgan's letter is a brief report, made by Thomas Clark, who, at the request of his neighbors had gone to Long Island to gather correct information respecting the fly, and the means of escaping its depredations. He became well satisfied that the Underhill wheat was fly proof, and could be obtained in any desired quantities, at the moderate price of $1.25 per bushel. He also reports the interesting fact, that the fly had now become so reduced in its numbers on the west end of Long Island, that many of the inhabitants supposed there had been none the present year, though he himself saw it there quite common still. Since 1779 their crops had been destroyed more or less every year, until the present.

In 1788, a communication in *Carey's Museum*, (vol. iv. p. 47), from Buck's county, Pa., informs us that in the vicinity of Trenton, N. J., so much as the seed sown would not be harvested. Many farmers had plowed up their wheat crops in the spring, and planted them with corn. The fly also in this year commenced it ravages in the State of Pennsylvania. "Near seed-time last year, many persons on the Pennsylvania shore saw the insect so thick in the air as to appear like a cloud, coming over Delaware river."

Following this communication, is a paper signed "a landholder," who regards the eggs as laid in the grain of ripe wheat, and sowed with them; and proposes procuring seed from places not infested with the fly, as a remedy.

Messrs. Vaux and Jacobs, farmers of Providence, Pa., in July, 1788, made a tour through New Jersey and Long Island, for the purpose of gathering information respecting the fly, and the best modes of withstanding its attack. Their account is published in the *Philadelphia Packet* of August 21st, and is mainly occupied with a description of the Underhill wheat, and a full confirmation of previous reports respecting it.

On the east part of Long Island, where, as already noticed, the fly arrived in 1786, it so rapidly multiplied, that the following year many fields were nearly destroyed, and this year the third of its presence, the wheat crop "was cut off almost universally." The red-bald, which was the common winter variety there raised; and the spring wheat were equally affected. Rye in many fields was much injured, and a field of summer barley was wholly destroyed. (*Havens*, p. 73).

Wheat in large quantities, was at this period exported hence to Great Britain. Accounts of the appaling bavoc that this insect was making, excited the attention of the government there, and aroused their fears, lest so dreadful a scourge should be introduced into that country, by means of the American grain. "The Privy Council sat day after day, (says *Kirby and Spence*, vol. i. p. 50), anxiously debating what measures should be adopted to ward off the danger of a calamity more to be dreaded, as they well knew, than the plague or pestilence. Expresses were sent off in all directions to the officers of the customs at the different outports respecting the examination of cargoes—despatches written to the embassadors in France, Austria, Prussia and America, to gain that information of the want of which they were now so sensible; and so important was the business deemed, that the minutes of the council, and the documents collected from all quarters fill upwards of 200 octavo pages." In consequence of the information laid before them, a proclamation was issued by his Britanic majesty, on the 25th of June, 1788, prohibiting the entry of wheat, the growth of any of the territories of the United States, into any of the ports of Great Britain. It has been remarked as very singular, that although the *entry* of American wheat was thus interdicted, it was still allowed to be *stored* at the different seaports, thus affording the obnoxious insects, if any of them had been contained in the grain, a very convenient opportunity to escape and make their way into the country!

When the news of the closing of the British ports against American wheat reached this country, the measure was at once regarded as having resulted from misinformation respecting the habits of this insect. The supreme executive council of Pennsylvania immediately addressed a letter to the Philadelphia ociety for promoting Ag-

riculture, requesting the society to investigate and report to the Council the nature of the Hessian fly, and particularly whether the quality of the grain is affected by it. The society promptly replied, "that from every communication made to them on that subject, they are decidedly of opinion that it is the plant of the wheat alone, that is injured by this destructive insect, that what grain happens to be produced from such plants, is sound and good, and that this insect is not propagated by sowing wheat which grew on fields infected with it." They also refer to the letters of Col. Morgan, and of Messrs. Vaux and Jacobs, as containing the best information extant, relative to the natural history of the insect, and the most successful method of preventing its depredations. (*Carey's Museum*, vol. iv. p. 244).

Dr. Currie took an active part in showing the government and people of England, that the information which had led to the closing of the ports against the entry of American grain, was wholly erroneous; and in eight or ten months the government bought the stored wheat at prime cost, kiln-dried it, and resold it at great loss. The prohibition was taken off almost immediately thereafter. (*Memoir of Currie*, ii. 65).

In 1789, as we learn from the *Encyc. Britann.*, the Hessian fly first reached Saratoga, two hundred miles north of its original station. From the statements of several persons who were residing in Washington and Saratoga counties so long ago as this date, it appears that the crops in this district of country, (at that day second to no other in the quantity of wheat which it produced,) first began to fail about the year 1790 or 1791. The insect reached here by a regular progess from the south, coming nearer and nearer each successive year. It continued to infest the crops during a number of the following years, sometimes severely, at others but moderately. On two or three occasions, many of the fields in Saratoga county were entirely destroyed. I do not learn that in this vicinity their devastations at any time reached this extent. About the year 1803, their last depredations were committed. From that time this insect has never been observed in this vicinity, that I can ascertain, until the autumn of 1845. In Rensselaer county, however, I am credibly informed, that it was quite injurious about the year 1810.

In 1792, the recently instituted New-York Society for the promotion of Agriculture, Arts, and Manufactures, issued part first of its *Transactions*, containing (p. 71–86), "Observations on the Hessian fly, by Jonathan N. Havens." This is the most valuable memoir that had hitherto appeared upon this subject, and few of those of a later date surpass it. After sketching the ravages of the fly in different years in his own vicinity, Judge H. describes with much precision its situation and appearance in the respective stages of its existence, showing that it passes regularly through but two generations in a year, instead of three or four, as anterior writers had stated. As remedies, he recommends sowing none but the bearded wheats, and burning or plowing up the stubble soon after harvest. This last important measure had never before been proposed; Judge H. had been led directly to it, by a close investigation of the habits of this insect.

The American Philosophical Society this year appointed from among its most competent members, a committee (Thomas Jefferson, B. Smith Barton, James Hutchinson, and Casper Wistar), "for the purpose of collecting and communicating to the society materials for forming the natural history of the Hessian fly." This committee immediately issued a circular, requesting all persons acquainted with any facts relating to this insect, its depredations, and preventives, to communicate the same by letter to their chairman. The numerous points upon which information was desired, were particularly detailed in an extended series of questions, which clearly indicate the importance which they attached to this subject, and the thorough investigation which they proposed making. (*Carey's Museum*, vol. xi. p. 285). It cannot but be regretted that this business, committed to such capable hands, was not pursued and brought to a close with the same zeal with which it was evidently commenced. We have met with no report ever rendered by them.

At this time, as we infer from a clause in the circular just alluded to, and also from some passages in Dr. Mitchell's address before the New-York Society of Agriculture (*Transactions*, vol. i. p. 32,) the insect was becoming so rare in all the more densely settled parts of the Middle States, which had been first overspread by it, that it was the common opinion that it would soon vanish from the country en-

tirely. Notices of it in the magazines and newspapers become more rare, and it was evidently ceasing to be regarded with that intense solicitude which it had hitherto excited. It was, however, with unabated vigor, continuing its progress southward. A letter from Prospect Hill, Delaware, dated June 12th, 1792, (*Carey's Museum*, vol. xi. p. 301,) states that the fly arrived there "in prodigious clouds," about the middle of the preceding September. It describes the place were eggs were deposited on the young wheat, the growth of the worm, and the perishing of all the plants, except those growing upon a rich soil, and adds further testimony in favor of the Underhill wheat.

In 1797, Dr. Isaac Chapman, of Bucks county, Pa., prepared one of the best accounts of this species that has ever appeared, containing the details of his own careful observations upon the insect and the time of its appearance in its different stages. These observations led him to recommend as the most certain safeguards against the fall attack, late sowing, and against the spring attack, a quick vigorous growth, to be obtained by procuring southern seed and sowing it on a rich, elevated and dry soil. His paper is published in the fifth volume of the *Memoirs of the Philadelphia Society for promoting Agriculture*, a volume which we regret having been unable to find in either of the largest libraries of this State. We are therefore obliged to depend for its contents upon second hand accounts. Dr. C. states that the fly was this year found upon the west side of the Alleghany mountains.

The eighth volume of the *Encyclopædia Britannica*, published this year, gives (pages 489–495) an extended article under the head *Hessian Fly*, consisting chiefly of a summary of the several documents laid before the privy council during their investigations.

In Dr. B. S. Barton's *Fragments of the Natural History of Pennsylvania*, issued in 1799, the author announces (p. 23) his intention of publishing "a memoir upon that destructive insect called the Hessian fly." It is probable that whatever communications were addressed to the committee of the Philosophical Society, had been consigned to his hands. We are not aware that the promised memoir ever appeared.

"About the year 1801, the Hessian flies first made their appearance in the neighborhood of the city of Richmond. We saw but little mischief that year. But in 1802 they were much more destructive—1803, they swept whole fields—about the same in 1804" (*H. M'Clelland, Amer. Farmer*, vol. ii. p. 234).

In the year 1803, we arrive at the first notice of this species, of a scientific nature. Dr. Mitchell, in a short article in the *Medical Repository* (vol. vii. p. 97, 98), entitled "Further ravages of the wheat insect, or *Tipula tritici of America*, and of another species of Tipula in Europe," states that it is now understood that our insect is a Tipula. He alludes to the extent of this genus, (ninety-four species being enumerated by Weber,) and though he has often examined our insect, and bred it so as to observe its transformations, he declines giving a decided opinion whether or not our species is different from all those that had been described. He refers to the species "treated as a nondescript" by the Rev. Mr. Kirby, in the *Linnæan Transactions*, copies its name and technical characters, and closes with the remark, that whether Mr. Kirby's insect is a new one or not, it is not the same animal which has been so injurious in this country. Had the doctor but added a few words descriptive of our species, he would undoubtedly be entitled to "the barren honors of a synonym." Respecting the depredations of the insect at this time, we learn from him, that "during the cold and dry spring of 1803 these creatures again infested the wheat more than they had done for many years. Many crops were cut off early in June, and the ground plowed up for other purposes.

During a long interval we meet with no further notices of this species. Its depredations would appear to have been so slight, and public attention was so much engrossed, with other affairs, that nothing, as we have discovered, is recorded of it.

At length, in 1817, it is stated to have renewed its ravages in various sections of the country. In the neighborhood of New-York and of Philadelphia, it is evident that it was unusually abundant, and in parts of Maryland and Virginia, it was perhaps more destructive than it had ever been before.

It was on the 24th of June in this year, that Mr. Say read before the Philadelphia Academy of Natural Sciences a paper entitled "Some account of the insect known by the name of Hessian fly, and of a parasitic insect that feeds on it." This contains an accurate technical description of the insect, on which he bestows the name of *Cecidomyia destructor*, and also of its most common parasite, referred by him to the genus *Ceraphron*, and also named *destructor*. This paper was published in the *Journal of the Academy* (vol. i. p. 45–48), issued in the course of the ensuing month, and was followed in August by a copperplate illustration of these insects, drawn and engraved by Mr. C. A. Le Sueur. "A local habitation and a name" were thus conferred upon this world-renowned species, by which it has ever since been definitely specified and arranged in works of science.

In the *American Monthly Magazine and Critical Review* for August, 1817, New-York, (vol. i. p. 275–279,) appeared a paper bearing the title, "An account of the wheat insect of America, or the *Tipula vaginâlis tritici*, commonly called the Hessian fly." This paper gives the substance of Judge Havens's memoir, and professes to copy a technical name and description which had been published by Dr. Mitchell in the *New-York Gazette* of July 3d. But whoever refers to the *New-York Gazette*, will find no attempt at a technical description, and no name except that of *Tipula Tritici*, which is in one instance, casually as it were, made use of. The word *vaginalis* is therefore an interpolation of the writer in the *Magazine;* and as he, at least on some subsequent occasions, refrained from bringing this name farther into notice, when a fair opportunity was presented him for doing so (as editor of *Hooper's Medical dictionary*, &c.) we doubt not, when the excitement of the day was past, he deeply regretted that he had ever drawn up an article so derogatory to himself as that which appears in the *Magazine*. We should therefore suppress all allusion to this subject, with the hope that it might pass wholly into oblivion, but that the article from the *Magazine* has of late years been copied into some of our agricultural journals, and has been referred to in terms of commendation by some names of respectability. With the currency thus unfortunately given to it, it will be read by hundreds who can never see the *New-York Gazette*, and will thus deem, that one

of our most distinguished savans had degraded himself by a paltry attempt to forestall Mr. Say in giving to this species a technical name.

Gen. John H. Cocke this year communicated his observations to the Albemarle Agricultural Society of Virginia. Having well ascertained that the fly deposits its eggs upon the blades of the wheat, at from a half to three inches from the central stalk, and that these remain there four or five days before they hatch, he recommends feeding off the crop, by pasturing sheep upon it; thus destroying the eggs, and depriving the fly of its wonted place for depositing them. "A King William Farmer" dissents from this advice, and thinks covering the seed to the depth of three inches the best safeguard against the fly. "A Frederick County Farmer" and Dr. Merriwether oppose this, and a controversy ensues, reaching through several communications in the *Richmond Enquirer* and *National Intelligencer*, and afterwards continued in the *American Farmer*, till in 1820 it was brought to a close by a valuable article from that distinguished agriculturist, the late James M. Garnett, (*American Farmer*, vol. ii. p. 174,) accompanied by an illustration, which would seem to clearly demonstrate the correctness of the statements first put forth by the King William Farmer. This subject will be fully considered in a subsequent part of this essay.

In 1820, Edward Tilghman, of Maryland, described (*American Farmer*, ii. 235) the place and mode of deposition of the eggs, he having in numerous instances watched the fly in the very act of ovipositing. At a later day Mr. T. has favored the public with a more full and exact description of this process, (*Cultivator*, viii. p. 82). James Worth of Pennsylvania, also in 1820 minutely described from his personal observations, the situation of the egg, its hatching, and the journey of the worm down the leaf to its usual nidus, (*American Farmer*, ii., 180).

In the second volume of the *Memoirs of the New York Board of Agriculture*, issued in 1823, is a communication (p. 169–171) on the Hessian fly, from Judge Hickock, who deems a fertile soil the best safeguard. In the third volume of the same work, published in 1826, (p. 326–338,) is a paper by the indefatigable secretary of

the board, the late Judge Buel, giving a condensed summary of all the information respecting this insect, contained in the accounts of Judge Havens, Dr. Chapman, and the different writers in the *American Farmer*.

In 1840, Miss Margaretta H. Morris, of Germantown, Pa., in a communication to the American Philosophical Society, revives the theory of "a landholder," already noticed, that the egg of the fly is deposited in the grain, and that obtaining seed from uninfected districts will therefore be the best safeguard. The report of the committee upon this paper, is inserted in the society's *Proceedings* of November, 1840, and the paper itself is published in the society's *Transactions* (vol. viii. p. 49-51). Communications bearing upon the same subject were also made to the Academy of Natural Sciences, in 1841, by Dr. B. H. Coates, (*Proceedings Acad.*, vol. i. p. 45, 54 and 57).

In 1841, Mr. E. C. Herrick, librarian of Yale College, gave "a brief, preliminary account of the Hessian fly, and its parasites," in *Silliman's Journal of Science* (vol. xli., p. 153–158). This paper announces the interesting fact of Mr. Dana's having met with apparently the same insect on the shores of the Mediterranean, details the writer's own accurate observations of the changes from the egg to the flax seed state, and enumerates four different parasitic insects that prey upon it during these periods of its existence, by which "probably more than nine-tenths of every generation of the Hessian fly is destroyed." Another valuable paper from Mr. Herrick appears in the *Report of the Commissioner of Patents* for the year 1844, (p. 161–167), giving a most exact and particular history of the transformations of this insect, and a summary view of the various remedial measures that have been proposed. Both of these papers evince the close and patient investigation which the writer had made, and the utmost carefulness in announcing nothing beyond what he had clearly ascertained.

Dr. T. W. Harris's invaluable "Treatise on the insects of Massachusetts injurious to vegetation" was also completed in 1841. An excellent summary of all the leading facts pertaining to the histo-

ry of this species, is given in this work, and its generic place, upon which point Mr. Herrick, Latreille and others had intimated doubts, is correctly settled.

The numerous agricultural periodicals of our country, abound with notices of this insect, more or less extended and valuable. To specify these notices in detail, at least as respects some of these periodicals, would require a reference to almost every number issued. Wherever important facts are derived from these sources, in the course of this essay, they are accompanied by a particular acknowledgment in each instance; an additional reference in this place, is therefore deemed unnecessary.

We close this section of our subject, with a condensed view of the depredations of this insect in different parts of our country, during a few of the past years; the materials for which, are furnished us, in those valuable documents, the yearly reports of the Commissioner of Patents.

In the year 1842, the ravages of the Hessian fly would appear to have been quite limited. Pennsylvania suffered the most severely. The wheat crop in this State is estimated to have been twenty per cent less than it was the preceding year, and of four different causes that produced this diminution, the fly is placed first. Some parts of Maryland, and also of Ohio, were visited by it. In the latter State it appeared to be increasing so much, that serious apprehensions were beginning to be felt respecting its future ravages.

In 1843, it was so abundant in western Pennsylvania in June, that it was thought it would diminish the crop twenty-five per cent. Through Maryland, and the great wheat-growing valley of Virginia, it was noticed at the same time as committing great havoc in many fields, and threatening a very decided failure in the crop; at harvest, however, the yield was found to be much better than was anticipated. In Ohio it was less injurious than in the preceding year. Upon some parts of Long Island it was observed, but in limited numbers.

In 1844, it seems to have been much more destructive than in either of the preceding years, and to have made its appearance pro-

minently in some districts where it had been unobserved before. Thus, through all the northern parts of Indiana and Illinois, and the contiguous parts of Michigan and Wisconsin, it did much injury, and in many places occasioned almost a total failure of the crops. Near Goshen, Ia., a person writes, the fly is taking the wheat here at a dreadful rate, destroying some pieces entirely; some fields have been plowed up, and corn planted therein. The *Prairie Farmer* states that the wheat crop has suffered severely in various sections by the fly. In Will county, Ill., says the *Chicago Journal*, several entire fields of both winter and spring wheat have been destroyed by the Hessian fly. In Michigan also, it is reported to have made sad havoc, particularly in light sandy soils. From different places in this State, we are told as follows: "In some cases the injury was so severe, that the farmers had to plow up their fields and sow them over again." "There is not more than one-fourth of the surplus of 1843, owing to the wet season and the ravages of the fly." "The wheat crop is almost an entire failure. The insects took it last fall, and the rust in the spring, and then again the insects a second time." It is also stated that the same enemy had made its appearance in great force at the close of the season, in the early fall sown wheat. From different parts of Ohio, the crop was reported in May and June to be suffering considerably from the ravages of the fly. In the vicinity of Masillon, it had never been so destructive before, whole fields being entirely destroyed. In the neighborhood of Rochester, N. Y., also, the fields suffered some, particularly those having a sandy soil, and that were early sown. On the west end of Long Island, its ravages were also bad, many farmers not having more than half a crop. Both in the eastern and western sections of Pennsylvania, the fly lessened the produce of this year. In Bucks county it was particularly destructive. One person states, in the month of June, that where he had expected to gather 1,200 bushels or more, he could not now hope for 300. Though it is noticed on both shores of the State of Maryland, the injury done by it here appears to have been but slight.

In 1845, through those districts of Michigan, Indiana and Illinois, where it committed such havoc the last year, it is said by different persons to have wholly disappeared. The *Prairie Farmer*, however, states that it was still present, doing more or less injury all over the

State of Illinois. Ohio sustained but little injury. It is not noticed north of Maryland, in the central parts of which State it is reported that on nearly all the light lands the Hessian fly made serious ravages, and in many instances rendered the crops totally worthless. In Georgia, moreover, its ravages in the counties around Milledgeville are said to have been dreadful; whole fields were totally destroyed, and others yielded not more than a fourth of an ordinary crop.

We regret that we have not at hand the requisite information, for tracing with equal precision the ravages of this insect during the past year, 1846. From such notices as we have casually observed in the public papers, we presume that through the country generally, it has been unusually numerous. In this vicinity, some fields have produced less than a fourth of what they would have done, but for the invasion of the fly last autumn, after an absence of over forty years, and its great increase in the spring. On sandy soils in Saratoga and the north-west parts of Rensselaer counties, several fields were observed early in July with the wheat stalks so "few and far between," that no harvesting of them would be attempted; whilst many others had been, at an earlier period of the season, plowed up and occupied with spring crops. In the western section of the State, it has also been quite destructive. The loss from the fly alone, says the *Genesee Farmer*, (vol. vii., p. 251,) will doubtless be at least 500,000 bushels. In those districts of Illinois, Wisconsin, and Iowa, which are contiguous to the Mississippi river, it appears to have been common, and also in eastern Pennsylvania. From a minute in the proceedings of the trustees of the Maryland Agricultual Society, we learn that "so great ravages have not been committed by the Hessian fly, since 1817. On some of the best land wheat has been plowed up, and other portions are so much injured, that they will not be worth harvesting. At least one-half of the crop of Talbot county has been destroyed." And in the upper counties of Georgia, it is said, "the fly has committed such ravages upon the wheat, as scarcely to leave enough seed for another year."

Its Name and Synonyms.

It is a somewhat trite but very true adage, that "names are things." Every one who has had occasion to search through files

of our agricultural journals for information respecting any particular insect or other malady to which our crops or herds are subject, well knows what doubt and perplexity is often occasioned from having two or more names used by different writers for the same thing, and also from having two or more distinct things designated by the same name. To illustrate this, let us refer to the *Patent Office Report* for 1844, p. 26, where, in thirteen consecutive lines, we read as follows: "Near Onondaga county the wheat is said to be injured by the *grain worm*. . . . . In Schoharie we find complaints of the *weevil*. . . . . In Schenectady county the ravages of the *fly* were great. . . . . In parts of Columbia county it suffered from the *maggot*. . . . . In Dutchess a yellow *worm in the head* destroyed it." Of a truth, "what a host of enemies!" By way of climax, we only require some wiseacre who has never seen the insect, or lived within a hundred miles of it, to say, "Good people, you are all wrong; *wheat worms* is the correct name for your insect"—and we are furnished with a tolerably complete list of the popular synonyms of the *Cecidomyia tritici!* But who, not intimately conversant with its American history, would suspect this single species of being designated by such a profusion of terms. Who, on reading the page referred to, of the *Patent Office Report*, (and it is a correct transcript of the very words which are in popular use,) but would receive its statements as conclusive evidence that we had in eastern New-York at least four or five kinds of destructive insects preying upon our wheat crops. Such mistakes are the inevitable result of a diversity of names. So important, therefore, do we deem this topic, that we are induced to assign to it a distinct head.

It is very fortunate that no confusion of the kind just alluded to, has ever existed with reference to the species under consideration. Its popular name, *Hessian fly*, was first bestowed upon it by Colonel Morgan, soon after its appearance on Long Island. Some two or three of the earliest writers allude to it by the names of *Hessian bug*, and *Hessian insect*, but these designations were speedily dropped, and Hessian fly became universally the only name by which it was definitely distinguished, not only in this country, but in all parts of the world where the English language was spoken. Even when it was by every one deemed to be a native insect, and the epithet

Hessian was therefore remarked by different writers as most inappropriate, still it was in such universal use, that no one ventured to propose that it should be changed. And this continues to be the only name by which it is spoken of at the present day, with one or two exceptions. In the Ohio Cultivator it is designated as the "wheat fly," and in late volumes of the Genesee Farmer the names Hessian fly and wheat fly are indiscriminately applied to it. The name "wheat fly," however, had been anteriorly and extensively applied to the *C. tritici*, upon both sides of the Atlantic, and was indeed the only common name of that insect in use among writers in agricultural journals and popular treatises, until recently, the perhaps more judicious name of "wheat-midge," has been bestowed upon it, by some of the best foreign authorities.*

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* We may here state some additional reasons which induced us in our former essay, to adopt the name "wheat-fly" in preference to that of "wheat-midge," the name by which the *C. tritici* has been designated by Mr. Curtiss, Westwood, and some other recent writers.

1. The insect itself, is, next after the wholly inappropriate name of "weevil," most commonly called "the fly," we believe, in all those districts where it is most abundant and has been longest known. It is never called "the midge." Why, then, should we speak one common name, and write another; or have in print as the common name, what we well know *is not* the common name.

2. No other insect in the world has a popular name better established than the Hessian fly. Both it and the *C. tritici* will undoubtedly continue to be common insects in this country, and very frequently spoken of. If one is called the Hessian *fly* and the other the wheat-*midge*, every person not well acquainted with this subject, will imbibe the idea that they are very different insects, their names being so dissimilar; whereas, they are most closely allied to each other.

3. It has often been remarked as a great desideratum, that the technical and common names of species in natural history, should correspond with each other; or, in other words, that the common names should in all cases where practicable, be translations of the technical names. *Cecidomyia tritici*, literally rendered in English, is *gall-fly of the wheat*; but inasmuch as this species does not produce galls, there is an obvious impropriety in retaining that word. *Wheat-fly* thus becomes the most direct translation of the technical name, that the habits of the insect admit of. No one will maintain that wheat-*midge* is a translation.

Dr. Webster is in error in saying the word "midge" is "not in use" at the present day. In the neighboring Green mountain districts, one or more most annoying species of *Simulium* that there abound, are daily designated in common conversation as the *midges*, or, as the name is often corrupted, the *midgets*. From Dr. Harris' treatise it appears that the same name is in popular use for the same insects in Maine. The term is limited in this country, we believe, exclusively to those minute insects, smaller than the musketoe, which suck the blood of other animals.

The scientific name, *Cecidomyia destructor*, bestowed upon this species by Mr. Say, is the only one belonging to it, neither the name *Tipula tritici*, nor *Tipula vagindlis tritici* having any legitimate claims to be retained as synonyms. Mr. Say's name might at first view be thought liable to criticism, as being in no wise distinctive, many other species of Cecidomyians being also *destroyers*. Yet this species is so preëminent in that particular, as to throw the injuries inflicted by each of the others quite in the back ground. We hence think it will be conceded that the name is signally appropriate. Placed beside it, all its kindred are mere depredators—this alone is THE *destroyer*.

Its Characters, Transformations, and Habits.

As a general rule, the Hessian fly passes regularly through two generations annually. The first of these occupies the autumn, winter, and fore part of the spring, and is reared at the roots of the young grain, slightly below the surface of the ground. The second occupies the remainder of the spring and the summer, and is chiefly nurtured at the first and second joints of the straw. The time when its several transformations occur, is not perfectly uniform, being varied by the climate, the state of the weather, and perhaps other contingencies; and it is not improbable that individual specimens, placed in circumstances unfavorable to their developement, have their growth retarded so much as to require even a whole year to complete their metamorphoses.

First Generation.

THE EGG. *When and where deposited.*—The eggs of the first generation are deposited chiefly in the fore part of September. Dr.

But, inasmuch as we have another common word (gnat), applied to species having in this respect the same habit, in the paucity of terms which our language furnishes by which to designate insects, it is desirable that no two of these terms should be employed as synonymous. And as the night midge (Anglo-Saxon *mygge* or *micge*, a swarmer,) is appropriate for all those minute flies which assemble together in aerial dances, it would be well to adopt it as the generic or family term for all the small Tipulidæ, and apply the term gnat only to the Culicidæ or musketoe family. This appears to be the mode in which the English entomologists at present employ these words. And in this country it will probably be more easy to bring the new name, wheat-midge, into common use as the distinctive appellation of the *C. tritici*, than to have any one of the names now bestowed upon it supersede all the others.

Chapman says the deposit is made from the latter end of August till the 20th of September, and most other accounts coincide with this, though some extend the time into October. On the 8th of October the fly was seen ovipositing in eastern Pennsylvania, in 1819, and it had wholly disappeared on the 11th. (*Amer. Farmer*, ii. 180). The deposit is doubtless made later, at the south, than in this vicinity. Mr. Tilghman's description of this process (*Cultivator*, viii. 82,) will convey so much more distinct a view to the general reader, than any other that has ever been published that we here insert it. He says, "By the second week of October, the first sown wheat being well up, and having generally put forth its second and third blades, I resorted to my field to endeavor to satisfy myself by ocular demonstration, if I could do so, whether the fly did deposit the egg on the blades of the growing plant. Selecting what I deemed to be a favorable spot to make my observation, I placed myself in position, by reclining in a furrow between two wheat lands. It was a fine, warm, calm forenoon; and I had been on the watch but a minute or two, before I discovered a number of small black flies, alighting and setting on the wheat plants around me; and so strong seemed to be their predilection for the wheat, that I did not observe a single fly to settle on any grass, or any thing within my view, but the wheat. I could distinctly see their bodies in motion when settled on the leaves or blades of the wheat, and presently one alighted and settled on the ridged surface of a blade completely within my reach and distinct observation. She immediately commenced disburthening her apparently well stored abdomen, by depositing her eggs in the longitudinal cavity between the little ridges of the blade. I could distinctly see the eggs ejected from a kind of tube or sting, or by the elongation of the body; the action of the insect in making the deposit, being similar to that of the wasp in stinging. After she had deposited, as I supposed, some eight or ten eggs, I easily caught her, upon the blade, between my finger and thumb..... After that, I continued my observations on the flies, caught several similarly occupied, and could see the eggs uniformly placed in the longitudinal cavities of the blades of the wheat; their appearance being that of minute reddish specks."

Its appearance and characters.—The account of the eggs, and also of the worms of the Hessian fly, as given by Mr. Herrick, is drawn up with such scrupulous care, and is so full and definite in every particular, that we are constrained to enhance the value of this essay by presenting it entire. He says; "The eggs are laid in the long creases or furrows of the upper surface of the leaves of the young wheat plant. While depositing her eggs, the insect stands with her head towards the point or extremity of the leaf, and at various distances between the point and where the leaf joins and surrounds the stalk. The number found on a single leaf, varies from a single egg up to thirty, or even more. The egg is about a fiftieth of an inch long, cylindrical, rounded at the ends, glossy and translucent, of a pale red color, becoming, in a few hours, irregularly spotted with deeper red. Between its exclusion and its hatching, these red spots are continually changing in number, size, and position; and sometimes nearly all disappear. A little while before hatching, two lateral rows of opaque white spots, about ten in number, can be seen in each egg. In four days, more or less, according to the weather, the egg is hatched."

The Larva. *Growth of the worm, or active larva.*—Mr. Herrick's excellent description is continued as follows, "The little wrinkled maggot, or larva, creeps out of the delicate membranous egg skin, crawls down the leaf, enters the sheath, and proceeds along the stalk, (see fig. *m*,) usually as far as the next joint below," (fig. B. §§,) or, in other words, *to the base of the sheath*, which in the young autumnal wheat, is at the crown of the root, (fig. A. §.) "Here it fastens, lengthwise, (fig. *n* and *o*,) and head downwards, to the tender stalk, and lives upon the sap. It does not gnaw the stalk, nor does it enter the central cavity thereof; but, as the larva increases in size, it gradually becomes embedded in the substance of the stalk. After taking its station, the larva moves no more, gradually loses its reddish color, and wrinkled appearance, becomes plump and torpid, is at first semitranslucent, and then more and more clouded with internal white spots; and when near maturity, the middle of the intestinal parts is of a greenish color. In five or six weeks (varying with the season,) the larva begins to turn brown, and soon becomes of a bright chestnut color, bearing some resemblance to a flax-seed, &c."

Its characters.—When freshly taken from the root of the wheat the mature worm (fig. *g*,) measures about fifteen hundredths of an inch (0.15) in length, by about 0.06 in breadth. It shows no signs of life when placed upon paper and turned over with a needle point. It is soft, glabrous, shining, white, oval and apparently composed of but nine segments, although twelve can often be distinctly perceived before its growth is completed. These are quite slightly marked by faint transverse lines of a greenish brown hue. Its under side is flattened, and has an oblong grass green cloud or spot in the middle, placed longitudinally. No regular contractions or crenatures occur along the margin to mark the segments, though after the worm has laid exposed to the air an hour, the color of the transverse lines above spoken of becomes bleached out as it were, and then, perhaps from the worm's having become somewhat dried, faintly impressed transverse lines are perceptible at the junction of each of the nine segments: faint longitudinal striæ are also discernable, as though produced by the pressure of the parallel veins or ribs of the sheath and culm, between which the worm had laid.

Its mode of feeding.—We have hitherto sought in vain to ascertain, by ocular and microscopic examinations, how it is that the worm imbibes its nourishment from the stalk. To expose it to view, we are obliged to place it in circumstances so unnatural to it, that it apparently refrains from feeding. That it "gnaws" the stalk, as some writers in our agricultural papers, and some compilers of popular treatises inform their readers, is an error so gross as scarcely to deserve notice. Some have supposed that it absorbs its nourishment through the pores of its skin; but we incline to the belief that Dr. Lee's opinion is nearest the truth of any that has been hitherto advanced—that it takes in its nourishment by suction, in a manner more analogous to the leech than any other familiar object. (*Gen. Farmer*, vii. 225).

Its effects upon the crop.—The autumnal attack of the fly is in a double sense a *radical* one. Each particular shoot at whose root one or more of these larvæ nestles, is commonly destroyed by the time the worm has attained its growth. The presence of these worms is therefore readily detected by an examination of the young wheat in October or November. Individual shoots will be found

here and there in the field, withered and changed to a light yellow color, (fig. A. †), strongly contrasting with the rich green of the vigorous uninjured plants, (fig. A. *). The frost or some other casualty may cause the ends of some of the other leaves to be of a pale yellow color, but here the whole plant is of that hue; and where a field is badly infested this yellow "sickly" aspect is perceptible from a distance. On examining the withered plants, the worm, or flax seed if it has advanced to that stage, can be readily found. It is situated a short distance below the surface of the earth, at the crown of the root, (fig. A. §). One or two radical leaves start from this point, their bases forming a cylindrical sheath around the central or main shoot, which as yet is but in its infancy. It is within this sheath, at its base, that the worms repose, one, two, three, or more, and by imbibing the nutricious juices of the young shoot, cause it to wither and die. The mechanical pressure of the larvæ, so frequently spoken of as impeding the circulation of the fluids of the plant, and hereby causing it to perish, I think has had too much importance assigned to it, the young plants being so soft and pliant that they would readily accommodate themselves to this pressure, if they received no molestation beyond this.

Is the crop ever benefitted by it?—The vigor and luxuriance of the uninjured shoots from the same root, contrasts so strongly with the wilted and feeble appearance of those attacked by the worm, as to have led some to believe that the unaffected shoots were stimulated to a more rapid and robust growth in consequence of the *pruning* given by the fly ; and that a better crop is thus sometimes produced, by the presence of a moderate number of these worms among the wheat plants. The correctness of this opinion we very much doubt. The worm is nourished and reared upon those very fluids that are absorbed by the plant and elaborated for its own sustenance and growth. Every particle of this nutricious juice, therefore, that is consumed by the worm, is a direct loss of just so much material that would otherwise become straw and grain. At all events, we think our farmers generally will prefer that nature should be left to her own undisturbed course in rearing their wheat plants, and will be by no means solicitous to have this renowned guest take any part in the operation.

Its change to a "flax seed" or dormant larva.—When the worm, or active larva, has fully completed its growth, a slight diminution in the dimensions of the inner soft parts of its body commences, in which the outer and harder skin does not participate, this latter retaining its original full size. The result of this contraction is, that the worm gradually cleaves from its outer skin. If examined with a microscope when this change has recently commenced, a slight translucent space is observable at the head end, and a larger and more obvious one at the pointed or tail end, plainly indicating that the enclosed worm does not entirely fill its outer skin. This contraction continues, until the worm becomes entirely separated from its outer skin, and lies within it like the finger within a glove. The outer skin at the same time changes in color. From its original whiteness and transparency, it gradually becomes opake, brown, and finally of a dark bay or chestnut color. Though *much less flat* than a flax seed, its resemblance in color, size, and form, to that familiar object, is so striking as at once to be remarked by every one.

Characters of the flax seed, or larva case.—Different specimens of these flax seed like larva cases (fig. *h. i. j.*) vary in length from 0.13 to 0.19 and in breadth from 0.05 to 0.08. They are shining, cylindrical-oval, more obtusely rounded at the lower or head end than at the other, which is generally attenuated into an acuminated point or small projecting papilla. They are commonly composed of but nine obvious segments, and these are but slightly indicated by very faint acutely impressed transverse striæ—a similar transverse stria, but still more faint, being sometimes perceptible (fig. *h.*) across the middle of some of the segments. Longitudinal impressed striæ are sometimes present, (fig. *j.*) more conspicuous than the transverse and reaching a part or the whole length of the worm; and between these the surface is minutely acuducted (i. e. appearing as if lightly scratched by the fine point of a needle) longitudinally—all these longitudinal impressions being perhaps caused by the pressure of the veins and fibres of the plant, against which the worm has been imbedded. On the under side, (fig. *i.*) towards the head end, the case is flattened, as if pinched together, so much so that the anterior segment seems a mere empty fold of the membrane, without any inflation sufficient to make room for internal

viseera. At this end is often observable one or two little brush-like granules, resembling those on the soles of the feet of some carabidous insects. (One of these is indicated on the anterior edge of fig. *i.*) Are these the relics of the suctorial mouth of the larva? This larva case is comparatively tough and leather-like at first, but becomes more brittle and also darker with age.

Characters of the dormant larva.—On carefully opening the larva case just described, a worm (fig. *k.*) is found within it, scarcely different in any respect from what it was immediately before entering upon this flax seed state. It has the same oval form, opake milk-white color, and green, cloud-like visceral spot or line beneath. The nine segments into which it appears divided, however, are now much more distinctly marked than they previously were, the transverse lines being more deeply impressed, and the margins showing corresponding crenatures. No traces of the members of the future fly are yet discernable. The insect now undergoes no further change, for a period of five months or more. Enveloped in its flax seed like mantle, and reposing at the root of the now lifeless grain, it is buried beneath the snows of winter. Over one-half of its entire term of life is therefore passed in this state.

Error in previous accounts.—This is the stage of this insect, which has been spoken of by all preceding writers as its pupa or crysalis state. Upon a close observation of *Cecidomyia tritici*, the writer succeeded in discovering that that species had, what some had conjectured, but none had actually observed, a regular pupa form, identical with that of other species of Cecidomyia, whose metamorphoses had been fully described. It hence appeared necessary to distinctly mark that long period of inactivity which intervenes in the wheat-fly, after the larva has completed its growth, and before it enters its pupa state; it was therefore, during this state of its life denominated a dormant larva, in my essay upon that species. It occurred to me whilst writing out that essay, that the dormant larva state of the wheat-fly, was exactly analogous to the flax seed state of the Hessian fly, and in a note, my suspicions were expressed that the real pupa of the Hessian fly had never been detected. The ample opportunities which I have since enjoyed for investigating

this species, have enabled me fully to trace out this point in its transformations, and to show that it is not till near the close of its flax seed period of existence that the Hessian fly puts on its pupa form. In penning the note just alluded to, I had overlooked a passage in Mr. Herrick's last paper, from which it is obvious that he has seen the real pupa of the Hessian fly, although he still speaks of its pupa state as commencing when the worm becomes a flax-seed. Inaccuracies of this kind, which to the general reader appear so trivial as scarcely to require correcting, are liable to lead to important errors. Of this, we have a striking illustration in this very instance. Mr. Westwood, on opening the flax seeds contained in the wheat straw from Germany, came upon "the larva," where, according to all the accounts of the Hessian fly he ought to have found *the pupa;* he therefore at once draws the important inference, that the German insect cannot be the Hessian fly of America. Indeed it is surprising, that so plain a fact as this, that it is a worm and not a pupa which is enveloped in the flax seed case of our insect, has been so wholly overlooked by every one who has hitherto written upon this subject.

The Pupa. *When formed.*—On the access of the first warm days of spring, as soon as the weather becomes sufficiently genial for some of our earliest plants to put forth their blossoms, the larva of the Hessian fly is rapidly stimulated to maturity. The present year, so early as the 21st of April, most of the insects were found to have taken on their pupa form. As this season was more forward than usual, this may prove to be an earlier date than is common for this occurrence; a more accurate criterion by which to indicate it definitely, is no doubt by a reference to the progress which vegetation has made at this time. We may therefore state, that in all parts of our country, the Hessian fly will probably be found in its fully formed pupa state, about a week after the liverwort, (*Hepatica triloba*,) the trailing arbutus (*Epigæa repens*), and the red or swamp maple (*Acer rubrum*,) first appear in bloom, and simultaneously with the flowering of the dry strawberry (*Comaropsis fragarioides*), the common five-finger (*Potentilla canadensis*), the hill-side violet (*Viola ovata*), &c. It continues in this state about ten or twelve days, and then sends out the winged fly.

Its characters.—The flax seed shell has now become quite brittle, breaking asunder transversely if rudely handled, and one of its ends slipping off from the inclosed pupa like a thimble from the end of the finger. On removing the pupa (fig. *l.*) from its case, it is found to be 0.13 long by 0.05 broad, of an oval form, with rounded ends, and having its limbs and body enveloped in separate membranes. The thoracic portion is slightly narrower than the abdominal. The wings do not quite attain the middle of the length of the body. The outer pair of feet come out from under the tips of the wings, and reach to the anterior margin of the penultimate abdominal segment, slightly curving inwards at their tips. The next pair of feet are somewhat shorter, and the inner pair are shorter still. They all lie in contact with each other, and in a direction parallel with the body. The abdominal segments are distinctly marked by strongly impressed transverse lines, and are of a milk-white color, the thorax and head being of a delicate pale pink-red, and the feet translucent-white. On the anterior margin is a chestnut-brown crescentiform mark. It will hence be perceived, that in all the details of its form, the pupa of the Hessian fly coincides precisely with those of the other species of this genus which have been described.

Its change into a fly.—The time for its final transformation having arrived, the pupa breaks open and crawls from its puparium or flax seed case, and works its way upwards within the sheath of the leaf, until it arrives at some cleft in the now dead, brittle and elastic straw; through this cleft it gradually, by bending from side to side, crowds its body until all except the tip of the abdomen is protruded into the air, the elasticity of the straw causing it to close together upon the tip of the abdomen, so much as to hold the pupa in this situation, secure from falling to the ground; and as if to preserve the body in a horizontal position, the feet are slightly separated from the abdomen, and directed obliquely downwards, with their tips pressed against the side of the straw, thus curiously serving, like the brace to the arms of a sign post, to support the body from inclining downwards. Thus securely fixed, and now freely exposed to the drying influence of the atmosphere, the outer membrane of the pupa speedily exhales its moisture, and as it becomes dried, cracks apart upon the back part of the thorax; out of this cleft the inclosed fly protrudes its head and thorax more and more, as it gra-

dually withdraws its several members, the antennæ, wings and legs, from the cases in which they are respectively enveloped—a proeess analogous to that of withdrawing the hand and its several fingers from a tight glove; until at length entirely freed, the now full-fledged and perfectly formed fly leaves its pupa skin and mounts into the air.

Peculiarity in its metamorphoses.—It is sufficiently apparent from the aecount that has now been given, that the Hessian fly differs notably from all its congeners in one important point in its transformations. From all the observations that have been hitherto made, the eecidomyians correspond with the other tipulides in this prominent particular—that their pupæ are naked. Other species, at least many of them, after completing their growth, cleave from their skins in the same manner that the Hessian fly does, but when the separation is formed, the inclosed worm invariably erawls from and forsakes its larva case. It is thus, even, contrary to what has been hitherto supposed, with the *C. tritici.* Since my essay upon that speeies was published, I have clearly ascertained that the mature or dormant larva does cast its skin. Indeed, this fact is distinctly related by Dr. Harris, in his treatise, to whom is due the eredit of having first announced it. His statement had escaped my observation when previously alluding to this subject. So far as I am aware, moreover, the cast skins in the several species are translucent, and of a membranous texture. In the Hessian fly, however, it becomes opake, ehanges its eolor, and is of a firm or coriaceous texture. The inelosed worm, also, does not leave it, but remaining, eventually ehanges within it to a pupa, the same case thus forming its puparium. Its metamorphosis thus approximates it to the Muscidæ or true flies, the Stratiomidæ or soldier-flies, &c., and its pupa, in technical language is "coarctate" and not "incomplete," like the pupæ of the other cecidomyians. Should usage, therefore, settle down upon the name *midge* as distinctive of the minute tipulides, there will still be a marked propriety in continuing to this species its old name, Hessian *fly.**

* I doubt, however, whether tho Hessian fly will continue to be the sole member of this genus having a coaretate pupa. Quite recently a speeies has occurred to my notiee, analogous to tho Hessian fly flax seed in every point that I have been able to

The Fly. *Its Characters.*—In the female, (fig. 3,) the *head* is flattened globular, and black throughout. The *antennæ* (fig. *e*,) are about half as long as the body, and composed of sixteen joints, each of a cylindric-oval form, the length being about double the diameter; each joint is clothed with a number of hairs, of which those towards its base are slightly more robust and longer, about equalling the joint in their length, and surrounding it in a whirl. The joints are separated from each other by very short translucent filaments, having a diameter about a third as great as the joints themselves. The terminal joint is at least a third longer than the preceding ones. The two basal joints of each antenna are globular, and compact or not separated by an intervening filament, and exceed the following joints in diameter. The *palpi* (fig. *f*,) consist of three obvious joints, clothed with very short minute hairs. The two last joints are cylindrical, nearly equal in size, and about twice as long as broad: the basal joint is more short and thick. The *thorax* is oval, broadest immediately back of the wing sockets, and black. The *scutel* is of the same color, projecting, and slightly polished, with the suture surrounding it sometimes fulvous. The *poisers* are dusky. The *abdomen* is elongate-ovate, its broadest part scarcely equalling the thorax in diameter; it is of a black color above, more or less widely marked at the sutures with tawny-fulvous, and furnished with numerous fine blackish hairs. The *ovipositor* is rose-red, and slightly exserted commonly in the dead specimen; it is susceptible of being protruded to a third of the length of the abdomen. The *wings* are slightly dusky, and fulvous at their insertion into the thorax. Their form and neuration is identical with that of the other species of this genus, except that the slight connecting nerve between the mediastinal and postcostal is commonly wanting, and the medial and forks of the anal nerves are extremely faint for a species of Cecidomyia so large as this. The legs are

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detect, except that its larva case is of a pale brown color, untinged with rufous or castaneous. It infests the *Agrostis lateriflora?*, numbers dwelling together in an imbricated gall, somewhat resembling the fertile aments of the hop, though larger, and connected with the main stalk by a short pedicel which is inserted into one of the lowest joints of the culm. From the coriaceous texture of the larva case, I suspect the inclosed worm will not leave it, until transformed to a pupa and upon the point of evolving the perfect fly.

pallid brown, the tarsi black, the femurs paler at their bases. The several pairs of legs equal each other in length, being about 0.24 long when extended, of which length the tarsus embraces one-half. The several joints of the tarsus are of the same relative length as in other species; the short basal joint however, is much more indistinct than usual, insomuch that a minute examination of several specimens is required ere one is met with showing this joint distinctly.* This character, and also the neuration of the wings, clearly shows that this species belongs to the genus *Cecidomyia*, and not to Macquart's genus *Lestremia*, nor Meigen's *Lasioptera*.

In the male, the *antennæ* (fig. *d*,) are three-fourths of the length of the body, with the joints of a short oval and nearly globular form, the diameter hardly equalling the length: each joint is surrounded with a verticil of longish hairs. The terminal joint does not differ from the preceding ones. The two basal joints are compacted together as in the female. The antennæ diminish very slightly in diameter towards their tips. The filaments separating the joints are smoky-translucent, nearly as long as the joints, and about one-third of their diameter. The *abdomen* (fig. 2,) is cylindric or slightly tapering towards its tip, and consists of seven joints beside the terminal one, which (viewed from beneath, vide fig. *c*,) consists of a transversely oval joint, giving off two robust processes, armed with incurved hooks at their tips; and between these processes at their base are two exceedingly minute papillæ. As ordinarily seen, in the living specimen, the abdomen is of a brownish-black color, more or less widely marked at the sutures with pallid fulvous or smoky whitish lines. In all other points the male coincides with the female in its characters.

Its duration.—That the fly which comes out in the spring continues but a very short time, I infer from the following data. A number of wheat plants, containing pupæ, were transplanted into a box of earth, April 21st, and inspected daily. On the morning of May 1st, about half of them were found to have sent out the perfect fly

* How well the engraver has executed his task will be obvious by passing a magnifier over the plate: The joints of the tarsi in fig. 3, and other minute details, scarcely, if at all perceptible to the naked eye, will then be distinctly recognised.

within the preceding twenty-four hours. On repairing to the field whence these plants were taken, the fly was found to be out in large numbers. At every step, a dozen or more would arise from their coverts, sluggishly fly a few feet, and alight again. In other fields, where none of the flax seeds could previously be found, an occasional fly was met with, on the same day. A week after this, on a thorough examination, no flies could be found, nor were but two specimens afterwards met with, until the coming out of the summer brood.

Second Generation.

After the full details that have already been given, but a few words will be required under this head. About the first of May the fly appears, and deposits its eggs upon the same crop of grain that has already reared one brood, and also upon any spring wheat that is sufficiently forward for its purposes. The radical leaves of the winter wheat are now more or less withered, and the fly therefore selects the more luxuriant leaves that have put forth above these. The worm hatches, and again makes its short journey to its future home, at the base of the sheath; it consequently now nestles at the first and second joints of the young stalk, and is sometimes, though rarely, as high as the third joint. Even before the worm reaches the base of the sheath, it has frequently grown nearly to its full size, (as shown, fig. *m*.). The stalk has now attained such vigor and hardiness that it is seldom destroyed by this spring attack. A slight swelling, immediately above the joint, (fig. B. §§,) commonly indicates the presence of the larva beneath. This is a fact which has been overlooked, or at least not distinctly stated by writers hitherto. We only find it noticed by Mr. Bergen, (*Cultivator*, viii., 133,) who informs us that in a crop of barley which was destroyed by the Hessian fly, many of the stalks were "at the joints as thick as a man's finger." The insect is therefore a true *gall*-fly, although when but one larva succeeds in reaching the joint, the swelling caused by it is but little if at all apparent. More commonly however, the straw becomes so weakened, that it is unable to sustain the weight of the wheat head, and it accordingly bends down (as represented, fig. B††,) with the force of the wind and rains. The appearance of a badly infested field, as harvest time approaches, cannot better be

described than in the words of M. Kōllar. The grain looks as though a herd of cattle had passed through it, so broken and tangled together is the straw. The worm attains its growth and enters its flax seed state about the first of June, and the flies of this second generation commonly come forth about the last of July and in August.

Miss Morris's theory.—We do not deem it necessary to go into a detailed examination of the theory revived by Miss Morris in 1840, that the eggs of the Hessian fly are deposited in the grain, and that the larva lies in the centre of the culm. We suppose this theory to be abandoned by its late advocates, from the fact that for four years past, we have met with no farther attempts to sustain it. To us it appears manifest that the lady was widely misled at the very outset of her observations by an error in Mr. Say's account, to wit, that "the perfect fly appears early in June." Were this the case, she might well enquire, "Where are the eggs placed? Surely not in the old and dying stalk .... and there is no young wheat growing from June until September." The flies which Miss M. saw in June, 1836, "in countless numbers, hovering over and settling on the ears of wheat," we cannot but suspect were the same species which in this section of country appears in such swarms upon the heads of wheat about the middle of June, that it has been for years mistaken hereabouts for the wheat-fly or midge, (vide *Transactions N. Y. State Agr. Soc.*, vol. v., p. 260 and 267). In size and color it does closely resemble the Hessian fly, and might readily mislead any one just commencing their observations. That occasional specimens of the Hessian fly may be taken in June we do not doubt; but that the main brood comes out, deposits its eggs, and disappears, a month earlier than this, we are quite confident, from our own observations as already related, as well as from the testimony of almost every writer who speaks definitely upon this point. Those few larvæ which have been found in the centre of the wheat culm, were not unlikely of some other species, since in this particular its habits correspond with those of the *Cephus pygmæus*, the *Chlorops pumilionis*, &c. That the Hessian fly larva resides in the sheath of the culm, and not in its centre, we feel confident Miss M. has herself become convinced ere this day:—so earnest and candid an enquirer

after truth, and one so capable of giving to every fact its due weight, cannot long remain in error, upon a point so susceptible of demonstration as this.

Its Parasites.

It is well known that one of the most effectual means for keeping the Hessian fly in check and preventing it from literally *swarming* all over our land, has been provided by nature herself. Other insects have been created, apparently for the very purpose of preying upon this, and thus preventing it from becoming inordinately multiplied. The world is indebted to Mr. Herrick for much interesting information respecting these insects, the result of his own accurate and patient investigations. As we purpose, should we succeed in more fully tracing out the history of these and other Cecidomyian parasites, making them a subject of a separate memoir at some future day, we refrain from devoting to them any considerable space in the present paper. The general reader, however, will scarcely pardon us, if we omit all allusion to them. We therefore subjoin a brief sketch of the contents of this part of Mr. Herrick's article.

The Hessian fly is preyed upon and devoured by at least four other insects. When its eggs are layed upon the wheat leaves, they are visited by an exceedingly minute four winged fly, (a species of *Platygaster*,) which punctures the egg and deposites in it four or six eggs of its own; the Hessian fly worm hatches, grows, and passes into its flax seed state with these internal foes feeding upon it: it now dies, and its destroyers in due time escape from the flax seed shell. Three other minute four winged flies, or bees as they would be called in common language, destroy the fly when in its flax seed state. The most common of these, by far, is Say's *Ceraphron destructor*. Alighting upon the wheat stalks, instinct informs them precisely where one of these flax seeds lies concealed. They thereupon "sting" through the sheath of the stalk, and into the body of the worm, placing an egg therein, which hatches to a maggot, lives upon and devours the worm. Such are the means which nature has provided for preventing this pest from becoming unduly multiplied. And so efficient and inveterate are these foes, that more than nine-tenths of all the Hessian fly larvæ that have come

into existence, are probably destroyed by them, Mr. Herrick thinks, and we have strong reasons for believing that his estimate is within the truth.

From the date given by Mr. Herrick of his first discovery of the egg parasite, we know that the first or autumnal generation is attacked by it. Whether it preys upon the second or spring generation also, does not so clearly appear. From our own observations, and the well known habits of the other parasites, it would seem to be principally upon the second or spring generation which they prey. Indeed we can scarcely conceive it possible for them with their short ovipositors to reach the flax seeds of the first generation, buried as these are beneath the surface of the earth and reposing at the roots of the young wheat. That these parasites are surprisingly abundant, and destroy immense numbers of the spring generation, any one can easily ascertain by collecting the infested straw at harvest time, and securely enclosing it, to preserve all the insects which hatch from it. He will thus obtain parasites in abundance, and only occasionally a Hessian fly. On the other hand, numbers of the young plants taken up by us in April, evolved nothing but Hessian flies. The observations of a single season, we are aware, cannot be relied on for establishing a point like this. But they force upon us the suspicion that it is chiefly the second generation that is infested by parasites, and that the first is comparatively free from them.

Remedies.

"An *effectual remedy*" against the Hessian fly, which has been so much inquired after and talked about, and by which term we suppose is meant some *specific* which will infallibly destroy or drive away the insect, or protect the crop from its ravages, never has been and probably never will be discovered. In truth, we regard the idea that a remedy of this character exists, as being equally absurd with a belief in the philosopher's stone. There is probably no such thing as sure and infallible specifics against any of the insects which invade our crops, any more than there is against those diseases which attack our persons. Still, believing this, we also believe that there is no noxious insect but what, when we closely study into its habits we can invariably discover some one or more ways of opposing it, by

which we can with certainty to a great extent, if not entirely, shield ourselves against its depredations. Thus it is with the insect under consideration. There is no remedy with which we can "doctor" it away—no charm with which we can say to it, "vanish presto;" yet there are measures, which employed, will guaranty fair crops, when if not resorted to, no wheat will be gathered. Of this fact we are well convinced, both from personal observations, and the concurrent testimony of a cloud of witnesses.

A consideration of the various remedial measures which have been proposed, is therefore a subject of surpassing interest to every cultivator of the soil. We shall hence proceed to review them in detail, treating first of those, which, after a careful consideration of this topic, we regard as the most important.

1. *A rich soil.*—This is a safeguard which has been strongly urged by almost every one who has written upon this insect. Indeed an inspection of different fields of wheat in a district where this enemy is present, cannot fail to impress upon the observer the utility and importance of this requisite. Other things being equal, the crops on impoverished lands invariably suffer the most. Hence those on sandy soils, which retain the strength of fertilizing agents less than other soils, have in numerous instances been remarked as most severely devastated. A striking contrast, even, may very often be perceived in different parts of the same field. The summits of the knolls and ridges, situations where the soil is the most meagre, almost invariably show the greatest amount of damage; whilst the intervening hollows, to which the fertilizing matters are washed from the surrounding acclivities, sustain a comparatively slight if at all sensible injury. Yet the latter situations are the very ones which insects of this family are known to be most prone to frequent, being more low, shady and damp. There can be no doubt, therefore, but the fly is as numerous in the hollows of a grain field, as upon its ridges; and that it is only in consequence of the greater fertility of the former situations, that the crop there, is enabled so effectually to withstand this enemy. Indeed, the farmers themselves, in districts where the fly has prevailed, have all learned from experience, that it is only upon fertile lands that it will do to sow their wheat. Hence Ezra L'Hommedieu long ago intimated that the

Hessian fly on Long Island, by driving the farmers to manure their lands, instead of a curse had actually been *a blessing*. He says, "the land in Suffolk county and other parts of Long Island, was easily tilled, and by continual cropping with wheat was so reduced, that on an average not more than five or six bushels was raised to the acre. This mode of husbandry was still pursued, and although the land was gradually impoverished, the farmer found the crop, although small, more than would pay for his labor and expense. The Hessian fly put an end to this kind of husbandry, and in that respect has proved a blessing instead of a curse; no other way being found to prevent the injury done by this insect, but by highly manuring the land." (*Trans. N. Y. Soc. for Prom. of Agric., &c.*, i. 57). A writer in Delaware also states that the universal predilection there, was to have *large* rather than *rich* fields of wheat; that this insect was counteracting this, by compelling them to cultivate less land, in order to cultivate it well; and that its tendency consequently was, to make our population more dense, by making it the interest of every man to own no more land than what he could manure highly and till carefully. (*Carey's Museum*, xi. 301). We thus have, even in the devastations committed by this destroyer evident indications of that

"All partial evil, universal good,"

which is every where manifest in the works of the Supreme Architect of nature. It is doubtless the additional strength and vigor enjoyed by plants growing upon a rich soil, which enables them to withstand the depredations of this insect. Those shoots which are first sent up from a kernel of seed, are the ones which are commonly attacked and destroyed, and in an impoverished soil the seed itself thereupon perishes; whilst in a rich soil, its vitality continues, and other shoots are sent forth by it, which grow vigorously and unmolested. In the spring attack also, the weak and slender stalks growing upon a poor soil, are much more liable to become broken and fail of maturing any grain, than the large, robust, well nourished stalks of a fertile soil. Hence a rich soil enables a plant to elaborate a sufficient amount of fluids for its own sustenance, in addidition to that which is abstracted from it by a few of these insects. We therefore regard this as a primary and indispensable measure, and one which must accompany others next to be considered, in orer to their full success.

2. *Late Sowing.*—This measure also comes to us sanctioned by the almost unanimous recommendations of writers; and we regard it as one of the most efficient, as it certainly is the most facile of any that can be resorted to. It is universally admitted that it is the earliest sowed fields that are always the most infested; and we cannot but suspect that the present visit of this enemy to this section of the country, after so long an absence, has been invited by the general practice of early sowing, resorted to by our farmers under the probably incorrect idea of hereby escaping from the depredations of the wheat-fly. Just before harvest, our attention was directed to two contiguous fields of wheat in the town of Stillwater, one of which was seriously injured by the Hessian fly, whilst in the other not a solitary straw broken by the insect could be found. The only cause to which this striking contrast could be imputed, was, that the latter field had been sowed a fortnight later than the former one. Analogous instances have often occurred to the notice of every observing person living in districts where the fly has been present. Such cases, however, must not be deemed to prove so much as they at first view appear to. It is not probable that the fly had entirely ceased from depositing its eggs before the second of the above fields had become forward enough for its purposes. Had the sowing of the first field been delayed a fortnight, both fields, it is probable, would have suffered equally. The whole injury that fell upon the first field, would thus have been divided between it and its neighbor. And so in all cases, we presume that the field which is the earliest, attracts all of the insects in its immediate vicinity, and these finding all the accommodations they desire there, have no occasion for going elsewhere. For a more extended elucidation of this topic, see the *American Farmer*, vol. ii. p. 167. Two objections have been urged against late sowing; the liability of the young plants to "winter-kill," and of the crop when near maturity to be attacked by "the rust." There is little danger of the first of these casualties, we suppose, upon porous soils, it being a disaster almost peculiar to stiff clays, which retain a large amount of moisture at their surface. In such soils, therefore, it may be advisable to resort to the plan employed in some parts of England, namely, sowing only on a newly turned over sward, the grass roots in which

serve to bind the soil together in such a manner as to retard its "heaving" by the frost. (*Fessenden's Complete Farmer*, p. 114), This disaster, moreover, is guarded against in a great degree by sowing only upon a very fertile soil, whereby a quick and vigorous growth is secured, and the young plants are thus enabled to acquire sufficient strength of root to withstand the winter's frosts. The same expedient, also, by insuring a rapid growth and an early maturity of the crop is the best safeguard against the rust, a disaster to which late crops only are ordinarily liable. Upon rich land, therefore, scarcely any scruples need be entertained with regard to late sowing. If a neighboring field has been already sowed and the season is favorable for its vegetation, it will be safe to commit the seed to the ground within a week or two thereafter, as all the insects in the vicinity, unless they are present in immense swarms, will be attracted to and remain in the earlier crop. About the last of September is probably as late as it will be judicious to defer sowing wheat in this climate; and in most seasons this will secure it from any serious attack of the fly. Although when it comes forward, the season for the deposition of the eggs of the fly may not in some years be entirely over, it must be rare that a number of these sufficiently large to be materially injurious, will be laid; but should that at any time be the case, other remedies still can thereupon be resorted to, to counteract the evil.

3. *Grazing*.—This measure is alluded to as worthy of attention, in the first account of this insect published in this country, where the fact is stated, that "by feeding the crop very close in the winter and spring, if the land is rich it will again spring up, and the worms do not much injure the second growth." It is plain that a close fed crop will furnish few leaves for the fly to place its eggs upon, and these leaves will be commonly consumed before the eggs are hatched. Gen. Cocke directed public attention strongly to this measure in 1817, and six years subsequently states that full experience had amply confirmed him in his estimate of its efficacy.—(*American Farmer*, v. 241). If in autumn it be omitted till after the eggs are hatched, and the worms have descended to the root, it can obviously be of little or no service. When, therefore, an attack of the fly is feared, as the exact time of the deposition of the eggs is somewhat variable in different seasons, it will be necessary to

watch the young wheat, as soon as two or three blades from each root appear; and if the fly is discovered profusely depositing its eggs, sheep or other stock should at once be turned upon it, in such numbers, if possible, as to eat down the crop in a few days. The eggs will thus be destroyed, and the favorite nidus of the fly for continuing this deposite, will be effectually broken up: it will thus be compelled to resort to other quarters. The same process may also be repeated in the spring, if found necessary. No injury to the crop need be apprehended from its being thus grazed down, if the soil is of due fertility — it soon and entirely recovers from this operation. Moreover, if the soil is poor and impoverished, the fly will be sure to injure it far more than what the sheep will do. We cannot, therefore, but regard this as a most judicious and important measure, if seasonably resorted to. The intelligent wool grower, will scarcely require to be informed, that sheep taken from their ordinary walks, should at first remain upon the rank feed of the wheat field but an hour or two of a day.

4. *The roller.*—Passing over the grain with a heavy roller, is a remedy in commendation of which several writers concur, supposing that many of the eggs upon the leaves will thus be crushed. Col. Morgan was in the habit of both rolling and grazing his wheat fields, before the Hessian fly appeared in his vicinity; and as his crops were much less injured than those of his immediate neighbors, he attributes his escape to these causes. If there be any foundation for Mr. Smeltzer's opinion, that certain varietes of wheat are fly proof, because their leaves grow horizontally instead of inclining upwards, assuredly by a repeated use of the roller every kind of wheat may be made fly proof. No doubt this measure is a judicious one, particularly on fields that are so smooth and free from stones that almost every plant will receive a firm pressure by the operation. If resorted to, it should obviously be done at those times when the eggs are newly laid upon the leaves. After all, is not the efficacy of the roller, at least in part, owing to its loosening and dislodging the eggs from their position and causing them to drop to the ground, where the worm, hatching, is unable to find its way into the sheath of the young plant? This point merits investigation; for if there is any truth in the suggestion, sweeping the plants with a broom or

some similar implement, will probably brush off much greater numbers of the eggs than passing a roller over them can do.

5. *Mowing.*—Mr. Goodhue, of Lancaster, Wisconsin, in a communication in the fifth volume of the *Prairie Farmer*, suggests that the larvæ concealed within the bases of the leaves, may be destroyed by mowing the wheat, and feeding it to the stock. We deem this proposal a valuable one for exterminating the second or spring brood from a wheat field. In those cases where the worms are discovered in the month of May, to be fearfully numerous at the joints of the young stalks, there can be little doubt but that on smooth grounds the scythe may be so used as to take off almost every spear below where the larvæ are lodged; and that thus a second growth of stalks will be produced, quite free from these depredators. The following facts incline me to believe that on a fertile soil, wheat may be thus mowed, with little if any eventual injury to the crop. Portions of a field of my own, the past season grew so rank, that deeming it would become lodged and mildewed, by way of experiment a space in it was mowed down after the plants were two feet in height, and another after the heads had begun to put forth. Though not so early in ripening, the appearance of these two patches at harvest, indicated, so far as a single experiment could do, that wheat might be mowed at the former period without any diminution of its productiveness, whilst at the latter, both the straw and heads would be of a more slender and feeble growth.

6. *Fly proof wheats.*—That there are any kinds of wheat which are perfectly "fly proof," (to use a common and expressive term,) as has been sometimes stated, we wholly disbelieve. At times when the fly is so excessively numerous as to attack barley and rye, it is not probable that any of the cultivated species of the genus *Triticum* can entirely withstand its attacks. But that there are kinds of this grain, that escape with little injury, when other kinds are almost wholly destroyed, is a well established fact. What the peculiar properties possessed by these varieties are, that render them thus singularly invulnerable, has never been investigated with that degree of accuracy, which so interesting and important a subject well merits. Mr. Worth supposes that fly proof wheats must have smooth leaves, affording no grooved or channelled surface to hold

the eggs of the fly. (*Amer. Far*, ii. 181). Mr. Smeltzer thinks the leaves of such wheat stand out horizontally from the stem, or incline downwards, instead of being erect, and that the egg is thus washed to the ground by rains. (*Patent Off. Report*, 1844, p. 434). The Hon. J. Taliaferro regards the immunity as proceeding from the strength and vigor of the roots, whereby the plant continues to grow, notwithstanding the exhaustion of its juices by the worm. (*Patent Off. Report*, 1842, App. No. 1). This theory appears to us more plausible and more in accordance with the facts recorded with regard to these varieties, than any other which has been proposed. Other opinions less specific, might be alluded to, but all of them are opinions merely, as we discover no evidence of their having been substantiated by a diligent investigation of this point. The reputation of the UNDERHILL WHEAT has already been sufficiently shown. This was a bearded white chaff, with a plump yellow berry, requiring to be thoroughly dried before grinding, and then producing flour in quantity and quality equal to the best of the other varieties. Its fly proof quality was by many supposed to be owing to the hardness or solidity of its straw. The fly freely deposited its eggs upon this wheat, but it was seldom, if ever, materially injured by it. The SPELTER WHEAT (*Triticum spelta*, Linn.,) was also long since remarked as never having been injured by the fly. This is so very inferior a species, that it is but little in use in this country, and only cultivated because it will grow well on the poorest soils, whether the season be wet or dry, and is free from all maladies. It has a long, slender, beardless head, with the chaff so firmly attached to the grain, that it can only be separated by passing through a mill, and yields a yellowish flour. It is more highly esteemed in Germany than in any other country, being there preferred even to all other kinds of wheat. The CHINA WHEAT, said originally to have been found in a crate of imported China ware, branches and grows very much like rye, ripens at least a week earlier than other varieties, yields largely, (forty or fifty bushels per acre it is said,) and has never been known to be injured by the fly. (*Pat. Off. Report*, 1844, p. 43). The MEDITERRANEAN WHEAT, in such high repute for its fly proof and other qualities, was introduced into Maryland in 1837. It is a slight red chaff, having a long stiff beard, a long, red, and very flinty berry, and ripens about ten days earlier than

other varieties. Mr. Garnett, in his Fredericksburg address, considers its only title to be designated as fly proof, is, that it recovers better than other wheats from the depredations of this insect. In the *South. Planter*, (vol. ii. p. 243,) it is said to be a coarse, dark grain, much like rye, and yielding such indifferent flour, that some of the merchants had announced they would buy no more of it. Its straw too, when grown upon a fertile soil is said to be too weak to support the head. Mr. R. L. Wright, in the *American Agriculturist* of 1843, and others, state that it improves by cultivation. As it becomes fully acclimated, it will, we doubt not, lose its most objectionable traits; but will it not with them also lose its fly proof and other qualities, which are its main recommendations at present? On the whole, this variety is so very prolific, and so exempt from all diseases, that we are not surprised at the marked favor it has received. It is admirably adapted for securing a premium in our agricultural societies, where, "the largest crop, raised at the least expense" receives the prize; but its grower will be reluctant to inform his neighbors, that he sells it in market at six cents per bushel under the current price. In fine, we think this noted variety can never come into general favor in those districts where choicer kinds can be successfully cultivated. The ETRURIAN WHEAT, brought home by Com. Stewart, so far as yet appears, possesses all the most valuable qualities, and none of the defects of the Mediterranean. This is a bald variety, having a strong and vigorous stalk, a beautiful long smooth head, yielding a round plump, white kernel, with a remarkably thin bran. It is very prolific, and quite as early as the Mediterranean, (Rev. D. Zollickoffer and others in the *American Farmer*,) and has thus far resisted the attack of the fly. We are gravely told by an anonymous writer, that "this wheat was not, as its name would indicate, brought from the little Island of Etruria." In what *creek* this "little island" is situated, we have been unable to discover, but with such a decided negation, we are driven to the inference that the grain in question was derived from a territory which we *moderns* call Tuscany. The WHITE FLINT WHEAT, one of the choicest varieties of western New-York, withstands the attack of the fly better than any of the other kinds there in use. For a full account of it, see Gen. Harmon's paper in the *Trans. N. Y. State Agric. Soc.*, 1843, p. 217. In conclusion of this branch of our

subject, we would observe, that we should by no means be solicitous of proeuring any variety of wheat, *merely* because of its fly proof qualities, believing as we do, that in all ordinary visitations of the fly, other measures are a suffieient safeguard. If vigor of root, firmness of stalk, and rapidity of growth, are, as would appear, the points which render these varieties fly proof, a fertile soil will certainly go far towards imparting to most other varieties the same quality.

7. *Steeps for the seed.*——These have been recommended with a two-fold view. 1st. To destroy the eggs; decoetion of elder, juiee of elder, boiling water, &c. These assume the erroneous position that the eggs of the fly are deposited upon the grain; it is manifest therefore that they can be of no utility. 2d. To insure a quick and vigorous growth of the young plant. Where sowing is deferred until late in the season, it may be judieious to resort to some measure of this kind to stimulate the seed to a more speedy and rapid germination and growth. In *Carey's Museum*, (vol. xii. page 182,) an experiment of a Poughkeepsie farmer is related, who had soaked his seed wheat in a solution of saltpetre, four ounces being dissolved in water sufficient to wet a bushel. After soaking twenty-four hours, it was spread out and dried twelve hours, and then sowed, so late as the first of November. Early in the following June, this erop is reported as being in advanee of neighboring ones whieh had been sowed early. This experiment, and others of a similar character, strikingly indicate that it lies mueh within the compass of human instrumentality to accelerate the growth of vegetation, by measures of this kind.

8. *Oats as a decoy.*—It has been recommended, to furnish a erop of young or of "volunteer" oats to the insect, on whieh to deposit its eggs; and when it has nearly or quite eompleted this operation, plowing the oats under, thus burying the eggs and larvæ, and then sowing the wheat upon their graves. To us, this appears only as "a tub to amuse the whale;" or in other words, an admirable project for wheedling honest "Farmer John" into late sowing, upon an enriched well pulverized soil. We have no elear evidence that the fly will deposite its eggs upon oats. It certainly will not be inclined to do so if there is any young wheat, barley, or rye in the vieinity to which it ean resort.

9. *Wheat as a decoy.*—The preceding measure suggests to us another, which is well worthy of the attention of the agriculturist. The facts recorded respecting this insect, clearly show that it is the earliest sowed and most forward fields of grain that are most infested. The fly is attracted to these fields, and finding a more luxuriant vegetation, and a more shady covert here than elsewhere, and meeting with all the accommodations which it desires, it here remains, even though adjoining fields separated only by an open fence, have come forward sufficiently to afford at least a part of the brood, quarters equally as comfortable. To us it appears evident, from these premises, that if one or two acres across the middle of a large field be sowed with wheat about the middle of August, all the flies in the vicinity will be attracted to this point, and there retained ; so that it will be perfectly safe to sow the remainder of the field by the middle of September. If the Hessian fly is common in the neighborhood, the early sowed strip will be badly infested. If so, let it be turned under by the plow, either after two or three severe frosts have rendered it certain that the season for depositing the eggs is fully past, or early in the following spring—resowing it with winter wheat in the former case, or with spring wheat in the latter. By this procedure all the larvæ will be buried and perish. Only in one contingency, as we can perceive, will this plan be inexpedient or liable to fail, namely, when the flies are present in such vast numbers, that the decoy thus prepared is inadequate fully to accommodate them. Upon this point, the amount of damage done at the preceding harvest, will enable the cultivator to judge with a considerable degree of certainty. The advantages which this plan promises, are, that it draws all the insects of the neighborhood together, and destroys their entire progeny ; it enables most of the grain to be sowed as early as is desirable ; and finally, there will no second or spring generation come forth in the field to attack any part of the crop. This measure therefore, should receive a fair trial from some intelligent wheat grower in a district suffering under this pest.

10. *Deeply covering the seed.*—From the letters of a King William County Farmer, and from the specimens furnished by him to Mr. Garnett, which are figured in the *American Farmer*, (vol. ii. p. 174,) the following facts would seem to be conclusively established,

to wit :—That when a kernel of wheat is buried to the depth of about three inches, it sends a single stem upwards, which, within an inch of the surface forms a crown, sending from that point a tuft of fibrous roots downwards, and a tuft of blades upwards ; these become the main roots and stalks, if undisturbed. But if these be destroyed by the fly, a new set of shoots and roots start directly from the deep buried kernel, and these latter shoots are never attacked by the fly. A kernel but slightly covered, on the other hand, sends up its blades at once directly from the seed ; if these be attacked therefore, the whole is destroyed. Such is a brief but plain statement, we believe, of the argument of the King William Farmer. In other words, seed slightly covered can send up but a single set of shoots, and being attacked by the fly, the whole perishes ; but seed deeply buried can send up a double set of shoots ; those first appearing are attacked and destroyed ; those which thereupon start directly from the seed are never infested by the fly. Admitting the facts to be as set forth, it amounts to this, that by deeply covering, the same quantity of seed in reality produces two crops; one, which is speedily harvested by the fly ; and the other, gathered at a later day by human hands. To this procedure we have two objections. By adopting it, you do nothing whatever towards destroying the insect or frustrating it in the least in its operations. On the contrary, you aim to provide food for it. You cherish it. You, in effect, say to it, "be fruitful, multiply, and replenish the earth." True, by giving it what it wants, it leaves us as much more. But it is rather humiliating to us "lords of creation" to rear crops "at the halves" and place ourselves in the rank of mere tenants to so ignoble a landlord ! Again, this measure only shields us against the autumnal attack. It does nothing against that of the following spring. Nay, by providing so well for the first generation, it tends to make the second generation more numerous, and the spring attack consequently more severe. Thus much upon the supposition that the facts are precisely as set forth by the King William Farmer. That he sincerely believed them to be correct, and that he was perfectly honest in the selection of the specimens which he forwarded to Mr. Garnett, we do not in the least doubt. Indeed the encomium which Mr. G. has written upon the character of his friend, must forever place him above all suspicions of insincerity or of anything approach-

ing to chicanery. But our own observations impress upon us strongly the conviction that he is in error in one most important point in his argument, namely, that seed slightly covered, dies whenever its blades are destroyed by the fly. It is only in an impoverished soil that it thus dies; in a rich soil, as has been already stated, its vitality continues, its roots are so well surrounded with nutriment that they readily sustain it, and its first shoots being destroyed, it sends up a second set which grow unharmed. It thus performs the same operation which the King William Farmer contends, it can only do when deeply buried. Our specimen, from which the drawing (fig. A,) was taken, plainly shows this fact. The illustration is an exact copy from nature, of two shoots which were separated from a tuft of similar ones, all growing from one shallow covered seed; and in every infested field which we have examined, myriads of similar specimens might have been gathered, whilst commonly only on knolls and other barren or dry parts of the fields were the plants found to be wholly destroyed, as they are represented in the figures of the *American Farmer*. A fertile soil therefore insures the same results which are claimed for a deep covering of the seed. In both cases, the shoots which first appear are destroyed; another set appear afterwards, which are unharmed—not because the seed is buried too deep for the worms to crawl down to it, as the King William Farmer seems to infer, but because there are no flies any longer abroad to deposite their eggs upon the leaves. The exact truth then, with regard to this matter, we are firmly persuaded is as follows. In a meagre soil, the seed will die, whether it be covered slightly or deeply. In a less impoverished soil, *if the weather be dry* in September as it frequently is, seed near the surface will often perish, when that which is deeply buried will survive. In a fertile soil the seed will survive, whether it be covered shallow or deep. That suits of specimens can therefore be easily procured which will appear to demonstrate a state of things in every particular the very reverse of those figured in the *American Farmer*, scarcely admits of a doubt. Our conclusion then is, that the King William Farmer is measurably correct in his position, but by no means correct to the extent contended for. When the Hessian fly is present in any district, deeply covering the seed, especially if it be early sowed, will in most cases be an additional safeguard against

its destruction. The measure is therefore good as a subordinate one, but it must fall far short of ranking as a primary one.

11. *Procuring seed from uninfested districts.*—This measure also, is based upon the erroneous supposition that the eggs are deposited upon the grain. It can consequently be of no utility whatever as a safeguard against the Hessian fly. The measure has been fairly tested in several instances without success.

12. *Sun-drying the seed.*—Mr. W. H. Hill, in the *Nashville Agriculturist* of 1842, states that for fifteen years his wheat crops had not been injured by the Hessian fly, whilst those of his neighbors had suffered more or less. This immunity he attributes to two causes; exposing his seed to the sun for two days previous to sowing it, and sowing none but the largest and fullest grains, the others being separated by a sieve. Doubtless stronger roots and a more vigorous growth is obtained by sowing large, plump seed. We think that effectually drying the seed in the sun can have but one effect, that of retarding its germination a short time—an end that may be equally as well attained, and with less trouble, by deferring the sowing until a somewhat later period.

13. *Drawing elder bushes over the young plants.*—We have here one of the fancies of a former day, it being supposed that elder possessed an odor or some more occult property, which rendered it peculiarly repulsive to insects. A trial of it against the Hessian fly, however, soon demonstrated that it possessed little or no virtue of that kind in reference to this insect. If any benefit ever resulted from it, it was probably only by dislodging and brushing off some of the eggs from the blades of the wheat.

14. *Sprinkling fine salt, ashes, or caustic lime over the young plants.*—The first of these measures was proposed, from its appearing at one time that wheat growing upon points of land exposed to the sea air was less injured than that growing back from the coast. Neither of these remedies, however, have been attended with success, in any case on record, and they probably are of no service whatever, except as they may slightly increase the fertility of some fields. There is no likelihood that the fly, its eggs, or larvæ can be materially discommoded by them.

15. *Burning and plowing up the wheat stubble.*—This measure was originally proposed by Judge Havens, and has been unanimously approved of and strongly urged by several of the most intelligent writers since. Indeed, a slight examination can scarcely fail of impressing upon every one its utility, independent of the sanction of authority. Whoever will at, or soon after harvest, inspect the stubble of a field that has been badly infested by the Hessian fly, will find these insects in their flax seed state lying one, two, three or more, at the joints of perhaps half the straws of the field. What a trifling labor, or rather what a pastime will it now be to set fire to this dry stubble, and hereby inevitably consume countless thousands of these destroyers. This point appears so plainly evident, that no one, we think, will hesitate in pronouncing this remedy decidedly the most important and valuable of all. But a thought breaks in upon us, of such fearful import, that fancying we see the burning brand extended, in an instant more to send a sheet of vivid flame, leaping, hissing, and crackling over the fated field, we involuntarily shout,

"Stop! or thy tread is on an empire's dust!"

Of a truth, what a short sighted mortal is man, and how often are the words of the poet verified, that "a little knowledge is a dangerous thing." Seeing his enemy chained to the stake, he exultingly rushes at once to fire the faggots, and lo, a dozen of his friends are immolated upon the same pyre! Is it not a fact, that whilst by this measure we consume the Hessian fly by hundreds, we inevitably destroy its mortal foes by thousands? And that the very means which we thus resort to for averting a future calamity are the surest means that could be devised for bringing that calamity upon us! If nine-tenths of every generation of the Hessian fly are destroyed by three or four other insects, who can calculate the value of the services which these latter are yearly rendering us? And who, then, will be so inconsiderate and ruthless as to destroy *nine* of these useful parasites, in order to exterminate *one* Hessian fly! Yet this must, in most cases, be the result of burning the stubble of the wheat field. We commenced our account of this remedy impressed with a belief that it was the best that had ever been proposed; we close it, persuaded that it is the very worst.

Brief Summary of the preceding History.

The Hessian fly (*Cecidomyia destructor* of Say,) is a European insect, and has been detected in Germany, France, Switzerland and Italy, where it at times commits severe depredations upon the wheat crops. Its ravages are alluded to so far back as the year 1732. It was brought to this country, probably in some straw used in package by the Hessian soldiers, who landed on Staten and the west end of Long Island, August, 1776, but did not become so multiplied as to severely injure the crops in that neighborhood, until 1779. From thence as a central point, it gradually extended over the country in all directions, advancing at the rate of from ten to twenty miles a year. Most of the wheat crops were wholly destroyed by it within a year or two of its first arrival at a given place, and its depredations commonly continued for several years, when they would nearly or quite cease; its parasitic insect enemies probable increasing to such an extent as to almost exterminate it. It is frequently reappearing in excessive numbers in one and another district of our country, and in addition to wheat, injures also barley and rye.

There are two generations of this insect annually. The eggs resemble minute reddish grains, and are laid in the creases of the upper surface of the leaf, when the wheat is but a few inches high, mostly in the month of September. These hatch in about a week, and the worm crawls down the sheath of the leaf to its base, just below the surface of the ground, where it remains, subsisting upon the juices of the plant, without wounding it, but causing it to turn yellow and die. It is a small white maggot, and attains its growth in about six weeks. It then changes to a flax seed like body, within which the worm becomes a pupa the following spring, and from this the fly is evolved in ten or twelve days. The fly closely resembles a musquitoe in its appearance, but is a third smaller, and has no bill for sucking blood; it is black, the joints of its body being slightly marked with reddish. It appears early in May, lays its eggs for another generation and soon perishes. The worms from these eggs nestle at the lower joints of the stalks, weakening them and causing them to bend and fall down from the weight of the head, so that towards harvest, an infested field looks as though cattle had passed through it.

Wheat can scarcely be grown except upon a fertile soil in those districts where this insect is abundant. The sowing should be deferred until about the last of September, the season then being past, when the fly usually deposites its eggs. If at any time in autumn the eggs of the insect are observed to be profusely deposited upon the leaves, the crop should be speedily grazed down by sheep and other stock, or if this cannot be done, a heavy roller should be passed over it, that as many of the eggs as possible may be crushed or dislodged thereby. One or the other of the same measures should also be resorted to in the spring, if the same contingency occurs; or if the worms are at a later date discovered to be numerous at the first and second joints of the young stalks, the experiment may be tried of mowing as close down as possible, the most infested portion of the field. Where the soil is of but medium fertility, a resort to some of the hardier varieties of wheat, which are known to be in a measure fly proof, may be advisable.

Fitch's Point, Salem, N. Y., April, 1847.

Note.—Since our preceding essay, upon the *Cecidomyia tritici*, was published, having had an opportunity of perusing the original articles of Mr. Kirby upon that species, we find that he both figures and describes the joints of its antennæ as "medio constrictio." It is singular that this most important distinctive mark has been so misstated in the descriptions of that species which have been republished upon this side of the Atlantic, and also in Turton's edition of the *System of Nature*. From the remarks introductory to our "Description," some might perhaps infer that this error arose with the founder of the species. We hasten, therefore, to obviate any such impression.

THE AGRILUS RUFICOLLIS.

By Prof. S. S. Haldeman.

Plate, *Fig. 1.*—This little insect, so hurtful to the raspberry, is about three inches long; black, minutely punctured, thorax and front brassy; front with a vertical impression; a wide shallow impression across the thorax posteriorly, and another at the base of the elytra. In this particular case, the knowledge of the appearance of the insect is not essential, as far as the means of preventing its depredations are concerned, although it is always interesting to know whence an injury proceeds.

In its larva state, Agrilus ruficollis lives at the expense of the cultivated *Rubus* (raspberry), in the heart of which the pupa may be found in the month of May, the imago appearing in June. The larva bores between the wood and the bark, injuring the plant, and causing a wide, unsightly excrescence. It next penetrates to the pith, which it traverses for two or three feet, finally excavating a cavity in which it undergoes its transformations.

It is probable that the larva feeds during summer and autumn, and passes the winter in the pupa state. The diseased stems are readily recognizable, and should be cut out and burnt in autumn, or early in the spring. The perfect insect is sometimes found upon the native *Rubus villosus*, which renders it probable that this genus of plants constitutes the natural food of the larva.

DESCRIPTION OF THE PLATE.

Fig. 1. *Agrilus ruficollis*, Fab. *a.* Its natural length.

Fig. 2. Hessian fly, male. (*Cecidomyia destructor.*) From a young specimen, having the fulvous sutures of the abdomen wide.

b. Its natural size.

c. Ventral view of the terminal segments of its abdomen.

d. Joints of its antenna.

Fig. 3. Hessian fly, female. (*C. destructor*, ♀.) From an older specimen, having the fulvous sutures narrow and in part obliterated.

e. Joints of its antenna.

f. Profile view of the head, palpi, and origin of the antenna.

g. Dorsal view of the worm or active larva.

h. do do "flax seed," or larva case.

i. Ventral view of the same.

j. Lateral view of the same.

k. Dorsal view of the dormant larva, taken from the larva case.

l. Ventral view of the pupa.

m. Wheat stalk; sheath broken away, showing the young worms on their way to the joint.

n. and *o.* Wheat stalks; sheath broken away, showing the "flax seeds" in their ordinary situation.

A. Appearance of a healthy (*), and of a diseased (†) shoot of wheat in autumn, the worms lying at §.

B. Appearance of a healthy (**), and two diseased stalks of wheat at harvest time. (††) Stalk broken, from being weakened by the worms. §§ Base of sheath swollen from worms having laid under it, and perforated by parasites coming from those worms.

ON THE CHOICE OF TREES AND SHRUBS FOR CITIES AND RURAL TOWNS

By D. J. Browne.

It has often been remarked by strangers, that, in sailing up the harbor of New York, they have been strongly impressed with the beauty of the scenery, particularly with the number and diversified forms of the trees; and that, after landing, the whole appears like one vast garden, interspersed, not only with many trees indigenous to the neighboring woods, but with those of the most distant climes of the two worlds. In progressing inland, or in either direction along the sea-board, the same features are observable, though in a less degree, in all of our cities and larger towns. It has also been remarked, that the foreign trees most conspicuous in the artificial scenery, in America, are various kinds of fruit-trees, the Lombardy Poplar, the Weeping Willow, the Horse-Chesnut, the European Lime-tree, the Ailantus, and the Paper-Mulberry. The contrast between the regular position and round-tufted heads of the fruit-trees, and the erect-branched summits of the poplars, and between these trees and the drooping heads of the willow and the ailantus, as well as between those of the wild luxuriance of the indigenous species, strikes the beholder with admiration. This love, or desire, for rural taste and ornament, speaks well for our people, whether they have been the most judicious in their choice and management, or not; and doubtless, the time is not far distant, when a due regard will be paid to the cultivation of such trees and shrubs for beautifying our parks, public high-ways, and private grounds, as will best subserve the purposes of health, ornament and shade,—and with this view the following brief hints are offered, not by the way of complaint, but merely as suggestions for future improvement.

Trans. N.Y. Agr. Soc. for 1847

AGRICULTURAL SURVEY.

The executive committee feeling the importance of a full and accurate agricultural survey of the State, secured the services of Asa Fitch, M. D., of Salem, Washington county, to make the survey of that county. From the well known reputation of Dr. Fitch, the committee feel themselves peculiarly fortunate in securing his services for this important work. He has commenced his labors and has pursued his investigations during the past summer and autumn, but has not been able to finish the survey, but will complete it the ensuing year.

The letter of the secretary, with the plan of the proposed survey, is annexed, and also a letter from Dr. Fitch, in relation to the survey. It is believed that the survey of this county, when completed, will furnish a pattern for other counties, and that a portion of the funds of the society can in no way be appropriated to more advantage to the agricultural interest of the State, than in continuing the survey of the State.

AGRICULTURAL ROOMS,
Albany, May 12th, 1847.

ASA FITCH, M. D.

Dear sir—You have been selected to make an agricultural survey of the county of Washington; to collect accurate information in relation to the state of its agriculture, and every subject connected with it; to suggest means of improvement, and to make report with as much exactness as circumstances will admit.

I enclose you a plan of the proposed survey, adopted by the executive committee of the New-York State Agricultural Society, which will direct your attention to such inquiries as are deemed most important. Your own experience will guide you in the fulness of examination and report under the various heads, some requiring from their importance much more extended notice than others.

The reports on natural history, which have been prepared under the direction of the Legislature, will aid you materially in some branches of the survey, as many of the inquiries submitted can be answered probably through them, and without as minute personal examination as would otherwise have been necessary.

As this is the first agricultural survey which has been undertaken by the State Agricultural Society, and upon its successful result will depend whether the survey be continued in future years to other counties or not, it becomes of the highest importance that the work should be done with such particularity and care, as will secure a complete and finished return. It is desirable that the survey, when completed, should be embraced in an octavo volume of some 200 pages; but this will depend in some measure upon the extent to which it may be lengthened by subjects of importance which may require particular notice.

The executive committee rely upon your ability to perform the work in a manner that will be creditable to the society, and so as to be an enduring monument to yourself in the future history of the agriculture of the State.

I am, very respectfully,

Your obedient servant,

B. P. JOHNSON,

Secretary N. Y. State. Ag. Society.

PLAN OF THE PROPOSED AGRICULTURAL SURVEY OF THE COUNTY OF WASHINGTON.

1. Geographical and topographical description of the county.

2. Geological features, minerals and fossils, nature of the soil, distinguishing that composed of the "northern drift" or of transported materials from that produced from the rocks of the immediate neighborhood.

3. Length of time the soil has been under cultivation; the original growth of timber, and the time it was first cut off.

4. Date of the first settlement of the several parts of the county, and the origin and general character of the settlers.

5. Condition and progress of agriculture from the first settlement to the present time, showing what have been the improvements and causes which have produced them; what have been the staple crops, the mode of their cultivation, and as far as may be practicable, the actual profits of each, at different periods.

6. Present state of agriculture; the several crops cultivated, their respective yields and market value. Also, all industrial pursuits connected with farming, such as the manufacture of maple sugar, how managed in its preparation, &c.

7. Adaptation of crops, as grains, grasses, and roots, to different soils, showing the arrangement which in this respect has been found by experience to be most judicious and profitable.

8. Fruits and fruit trees; having particular reference to the adaptation of the various species to the different soils (mentioned under head No. 2) and how far the productiveness, health, or longevity of the trees are affected by the nature of the soil, &c.

9. Weeds and pernicious plants, describing those most injurious, whether indigenous or introduced, and giving the most improved modes for their eradication.

10. Insects, describing those which are prejudicial to the farmer, and noticing the most effectual means of preventing their ravages.

11. Implements; having regard to any peculiarity of construction, and noticing any improvements which may have been adopted in their form, mode of manufacture, or uses.

12. Live stock; horses, cattle, sheep and swine; showing the numbers of each of these classes kept in the county, their diseases and mode of curing them; the different breeds, and as far as may be, the relative value of each for different purposes; the relative value of horses and oxen for labor on the farm; and any facts in regard to the profits and most economical management of poultry of different kinds.

13. Feeding and fattening animals; having regard to the most profitable modes, and the relative value of different kinds of grain, roots, apples, pumpkins, grasses, (both in their green and dry state) or any plants for feeding laboring animals, (whether horses or oxen,) milch cows, or for fattening cattle, swine or sheep.

14. Dairies and dairy produce; showing the quantity of butter and cheese produced, the quantity per cow, the best modes of making these articles, and the kind of pasture and food, as well as the general management, which is found most profitable.

15. Wool growing; showing the number of sheep in the county, the breeds, the quantity of wool produced per head, the value per pound of the different kinds of wool, its preparation for sale, and where sold; the number of sheep pastured per acre on different soils; time required for winter feeding; quantity of hay required for carrying a given number of sheep through the winter; most economical mode of winter feeding, whether with hay alone, or with any other fodder, and whether any and what kinds of grain or roots, and in what quantities, and in what manner, are fed to sheep.

16. Manufactures; the kinds carried on in the county, their extent and the effect they have had on the farming interest.

17. Examples of good management or success in farming.

18. General profits of farming; showing the returns for capital invested.

19. Education; the state of schools, and whether any instruction having a particular reference to agriculture is given in schools and academies, and with what success or advantage.

20. Suggestions for improving the condition of agriculture.

21. Zoology of the county; at least a notice of those indigenous quadrupeds, birds, reptiles, fish, &c., that are serviceable or detrimental to man.

To the Executive Committee of the New-York State Agricultural Society.

GENTLEMEN—It is with deep regret that I find myself under the necessity of making the announcement to you, that it is impossible for me to render the expected report on the agricultural survey of Washington county at the present time. Eight months ago I was honored with your appointment to perform this service. A previous engagement, as you was apprised when the business was first proposed to me, demanded a moiety of my time during the summer. The remainder of that time has been devoted to the work which you commissioned me to execute, and this has received my sole attention during more than half of the intervening period. But the points of enquiry are so numerous, and the territory to be examined so exten-

sive, that to this date I have not been able to visit some of the towns. Indeed, I may say, that in none of them have my investigations been so complete as I would like to render them. When it is remembered that the county embraces seventeen towns, occupying a territory over sixty miles in length, and for the chief part of that distance nearly twenty in breadth, it will be perceived that a thorough exploration of it could not be made within the time which I have as yet had to devote to it. Business of this kind, moreover, is far more laborious and slow of accomplishment, than any one not experienced in it would suppose. I have frequently deemed myself fortunate, if on a second or third call at the end of a ride of several miles, I have found the desired person at home, and so far disengaged from his own secular employments, that I could make free to detain him two, four or six hours, in responding to my numerous interrogatories.

To some of the branches of this work I would here briefly allude, that the nature and extent of these investigations, and the time requisite for completing them, may be more distinctly perceived.

It was very desirable that the exact elevation and height of different sections of the county should be ascertained, in order to show definitely the slope of its surface, the fall of its streams, its facilities for drainage, irrigation, &c. Instruments for this purpose were kindly furnished me by Prof. C. B. Adams, late of Middlebury, now of Amherst college; and assisted by my friend T. B. Culbertson, of Princeton seminary, observations were taken in the month of June, upon the summit of Black mountain on the east shore of lake George, the highest point in the county; Willard mountain in Easton, the highest point in the southern section of the county; Bald mountain, in Greenwich; the Pinnacle, in Granville; the dividing ridge in Hebron, whence the waters flow north into lake Champlain and south into the Hudson, and some other localities within the county, and also upon the summit of the Green mountain ridge in Vermont, east of the county. Mr. P. C. Ten Eyck, of the Albany academy, has favored me with a copy of the observations registered by him at the same dates for that institution, and I am hence enabled to determine, in a very satisfactory manner, the height of these points above tide water at Albany. These, in conjunction with the well known levels of the Champlain canal, and levels that have been taken in two or three instances in some parts of the county for proposed canals and railways, furnish ample data for presenting a definite and valuable account of its surface and features.

denouncing the most terrible war against all the hardened enemies of their king, and threatening to let loose the hordes of savages in his train, to search out in their coverts, and punish those who neglected putting themselves under his protection, the peril and alarm that pervaded this district, can better be imagined than described. The inhabitants, however, remained in their dwellings until the tomahawk and scalping-knife had actually commenced executing their awful work. The murder of Jane McCrea has resounded through the world. Strange as it may appear, other murders, simultaneously committed, which many will regard as still more horrid and atrocious, remain to this day untold in our country's annals. One such is specified by Gen. Gates, in his letter to Burgoyne, complaining of the barbarities of his Indians, where, in connection with Miss McCrea's murder, he says, "Two parents with their six children were all treated with the same inhumanity, while quietly resting in their once happy and peaceful dwelling." Burgoyne in his reply roundly asserts, "The above instance, (of Miss McCrea) excepted, your intelligence respecting the cruelty of the Indians *is false.*" Seventy years have elapsed since this correspondence; and the whole world seems to have supposed that Burgoyne's statement was correct. The particulars of the event alluded to by the American general, have all but passed into irretrievable oblivion. The plow, when it next courses over the ground, will obliterate forever the slight mark that yet indicates the spot, where in one grave, uncoffined and unshrouded, was hastily laid the gashed and gory corpses of a whole household! That Jane McCrea, voluntarily leaving her brother's house and placing herself upon the very confines of the hostile encampment, should meet the awful doom which she did, was a casualty imputable measurably to her own imprudence. But that a whole family, a *loyalist* family, the children and grandchildren of one of the leading loyalists of the township, while at rest in their own tranquil home, secluded amid the hills and far away from the camp, should without any provocation be suddenly massacred in cold blood, aye, and by the allies of that very king whom they loved so well—who so credulous as to give ear to such a tale; and who, believing it, could longer adhere to a cause blackened by such enormities? Who could thereafter rely on Britain's arm for safety, when the most confiding fell victims to Britain's hirelings? Whilst the murder of Jane McCrea, therefore, was ringing through the country, it was of the utmost moment, that no tidings of this more heinous and revolting murder, should get out to the world. And occurring as it did, in the midst of a loyalist settlement, Burgoyne, we suppose, succeeded in smothering it so ef-

fectually, that he felt himself safe in boldly denying it. "Justice to the unfortunate," has induced historians to place upon their pages his exculpatory account of Miss McCrea's murder, and his peremptory disavowal that any other Indian barbarities had been perpetrated. Truth and impartiality will demand that, in all coming time, that denial should be followed by an allusion to this enormity, showing how little the veracity of the British chieftain is to be relied on.

Full details of this, and of many other equally important events of that period, I find still preserved in the memories of the old people of this district. Brought up before me as they have been in connection with the other inquiries in which I am engaged, I have deemed it a paramount duty to carefully rescue from oblivion and preserve to the world, such impressive mementos of those pangs which attended a nation's birth.

That you may be enabled to judge of the interest and value of the *local history* of this district, and of the thorough examination I am making, I forward herewith the annals of one of its towns, from its first settlement down to the close of the year 1777—drawn out, I am aware, more in detail than will be desirable for the final report. Some of the other towns furnish materials for a historical narrative equally interesting, if not more so. To most of the present inhabitants of those towns, these incidents will be as new as they are to non-residents, they have so long since ceased to be the themes of conversation. It will readily be perceived that much time and close research, is indispensible, to duly gather up facts like these, as well as the numerous other matters that pertain to this survey. The labors of several additional months I find will no more than suffice to render the work on which I am engaged such an one as I have designed furnishing. Feeling that a partial and imperfect report would cause more disappointment than a temporary delay can do, I am obliged to request that another season be allowed me, to complete it.

Yours, &c.,

ASA FITCH.

Salem, N. Y., January 14, 1848.

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THE CURRANT-MOTH, *Abraxas? Ribearia.*

BY ASA FITCH M. D.

The gooseberry and currant bushes cultivated in the gardens of Europe, are known to be subject to the attacks of several insect depredators. Among the more conspicuous of these, are the larvæ of several species of moths, which subsist upon the leaves of these shrubs. Some are confined almost exclusively to the currant and gooseberry, or to plants of the genus Ribes. Such are the *Abraxas Grossulariata*, Linn., the *Halia vauaria*, Linn.; the *Electra Spinachiata*, Haw. &c. Whilst others feed indiscriminately upon these and several other vegetables.

The *Abraxas Grossulariata*, or "Gooseberry-moth," as it is commonly designated, is so very abundant in several European countries, that it has long been noted for the depredations which it commits. A history of this species, from the able pen of Mr. Curtis, is given in the Gardener's Chronicle, vol. i. page 515, which, to my regret, I have never been able to meet with. From other sources we learn that the Gooseberry-moth hatches from the egg in autumn, the young larvæ lives through the winter without eating, and is in readiness to attack the tender leaves of the gooseberry and currant when they first put forth in the spring. When fully grown, it is nearly an inch and a half in length, of a white color, the back with numerous black spots of various sizes, and low on the sides yellow sprinkled with black dots. The moth that is produced from these worms, measures nearly two inches across the wings, has a yellow body with rows of black spots, and white wings, the upper pair with two yellow and six interrupted black bands.

We have in Eastern New York a moth which will rank as the compeer of the European species in destructiveness, though varying from it somewhat in its habits, and in the characters which it presents, both in its larva and its perfect state. These characters sufficiently indicate that it is an insect different from all those that have been hitherto described by authors.

evening. The exact situation in which it deposits its eggs, I have not yet discovered. These remain, it is probable, during the autumn and winter, to hatch and produce another generation of worms the following May.

For at least three years past, the currant and gooseberry bushes of particular gardens in this district, have in June, been stripped of their leaves by these worms, so completely, that they would be bare as in winter, but for the dead stems and blighted fruit adhering to them. The long rows of these bushes in our gardens, when thus defoliated, present a dismal aspect, rendered more striking by the full luxuriance in which all the surrounding vegetation is arrayed at this period of the year. A second growth of leaves begin to show themselves within a week after the worm has disappeared, and the shrubs are hereby sustained against immediate decay: but no fruit is yielded by them, and this annual destruction of their foliage cannot but prove most pernicious to their health and vigor.

My attention was first directed to these worms in June 1846, when on a visit to the north part of this (Washington) county. Every garden in the village of Whitehall, I was informed, had been equally devastated by them, and eight miles south, in Granville, most of the gardens had shared the same fate. In one enclosure was an insulated cluster of bushes growing in the midst of a plat of tall grass, remote from any others, and it had been hoped these thus shielded would escape unharmed; but they were at length discovered, and suffered to the same extent with those more exposed. Air-slacked lime, and similar substances, had by some been sprinkled over their bushes, but without any benefit. A favorite gooseberry bush was shown me, over which a lady had tied her gauze veil, wholly enveloping the leaves within it. This had proved an effectual protection. The worms had traversed the gauze in all directions, their tracks still visible by the cobweb-like threads which they spun as they crawled over it; but no attempt had been made by them to eat holes through this delicate fabric, although the inclosed leaves were everywhere crowded against it.

Thirty miles distant, here in the southern section of the county, the moth is much less abundant; but particular gardens may be found which are annually suffering to the same extent as above related. Two such occur upon opposite sides of my own residence, less than a mile distant. And although from specimens preserved in my collection, I know the moth has been quite common in my own garden for four summers past, still it has not multiplied so as to commit any observable injury.

Further with regard to the extent of the geographical range of this species, I only know that a specimen of this moth was among some insects gathered at Saratoga Springs in July last; and another occurred in a collection in Albany which had been chiefly made in the valley of the Housatonic river the past season.

This insect is so closely related to the Gooseberry-moth of Europe, that we may confidently infer, that those measures only which have been found efficacious for checking the ravages of that species, can be of material avail against this. Numerous remedies have there been resorted to; such as sifting the fine dust of soot, of ashes, &c., repeatedly over the bushes; sprinkling with lime-water, or with decoctions of tobacco, of fox-glove, of elder, &c.; by successive shakes of the bushes, causing all the worms to descend to the ground, and then tying cabbage-leaves around the base of the stalks, over which, it was reported, the worms would not crawl to reascend. But none of these remedies have established themselves in public favor; and the only measure which is recommended with confidence, by all the more intelligent writers, is that of "hand-picking," as it is termed. This, though tedious, is said to be, in the end, the most economical of any measure known, and the only one on which full reliance can be placed. It is commonly accomplished by suddenly jarring the bush, and then with a forked stick or some similar implement, gathering those worms that have let themselves down by threads, and crushing them beneath the foot. This process requires to be repeated three or more times to free a bush from the worms, as but part of them let themselves down on the first agitation.

This remedy should be resorted to with our insect, as soon as the young worms are discovered upon the bushes, and if perseveringly followed up, will, no doubt, be effectual. The task, however, will be a formidable one, to thus free a garden of the countless numbers of these larvæ by which it is infested; and the measure can only be resorted to with facility in those gardens where the bushes are kept well thinned by pruning.

A less laborious mode of reducing the numbers of our moth, in badly infested gardens, it strikes me is so feasible, that some may be disposed to test its efficacy by giving it a trial. As already related, the worms having completed their growth, bury themselves slightly in the ground under the bushes, where they lie several days in their pupa state, and then the winged moths come from these pupæ and make their way out of the ground. Now if the surface of the earth beneath currant and gooseberry bushes be carefully levelled and made smooth with a rake, it will be but a slight labor, when the worms have mostly left the bushes and buried themselves, to closely cover

the ground beneath and around the bushes with boards, or pave it with bricks, should these be at hand, allowing this covering to remain three or four weeks The winged moths on coming from their pupa shells, would probably then be unable to make their way into the air, and would perish in their confinement. The efficacy of this measure would be indicated, on removing the boards, by the numbers of dead moths on the surface of the ground beneath them.

On first examining the larvæ of this insect, I felt confident that they would produce moths cogeneric with the European Gooseberry-moth. But when, a few days after, perfect insects were obtained, an inspection of them rendered it apparent that they could not be included in the genus Abraxas, as defined by its founder Dr. Leach, and by other English entomologists; nor was I able to assign them a satisfactory place in any of the genera of those authors which I had at hand to consult. On transmitting specimens to Dr. Harris, whose investigations of our nocturnal Lepidoptera so well qualify him for deciding every doubtful point of this nature, he favored me with the opinion, accompanied with a full statement of the grounds on which it is based, that although this species presents more points of affinity with Abraxas than with any other genus at present established, yet it cannot be included in that genus without a modification of its characters; which modification must be made, or a new genus must be constructed to receive our insect. Though fully concurring in this opinion, inasmuch as it is not the unaided result of my own examinations, I decline availing myself of it, and have therefore here placed the insect doubtingly in the genus Abraxas, bestowing upon it a specific name, which perhaps the general reader should be informed, indicates to the entomologist not merely the genus of shrubs on which the larva feeds, but also that the insect is a Geometrician-moth with feather-like antennæ.

Subjoining is a description of the moth, in its perfect and previous states, which, with the accompanying figures, cannot fail of rendering it well known and readily recognized by every careful observer.

Abraxas? Ribearia.—Nankin-yellow; body immaculate; wings with two brown bands, the outer composed of sub-confluent spots, whereof three in the middle of the anterior pair are more conspicuous and permanent. Wings expand slightly over one and a fourth inches.

The ground color of all parts of this moth is a light buff or nankin-yellow, which in old specimens fades to yellowish-white. The posterior wings are a shade lighter than the anterior, whilst the head and neck are commonly of a deeper tint, bordering on orange-yellow. The body is immaculate, but the *wings* are more or less variegated with spots or bands of a dull leaden-brown color. In the most per-

fect specimens (fig. 2) two bands, the inner one continuous, and the outer composed of sub-confluent spots, extend across both pairs of wings, but of a paler shade on the posterior pair, the inner one being here extremely faint. These bands are placed at equal distances from each other, and from the base and the outer margin. At their commencement on the forward margin of the anterior wings they are commonly of a ferruginous color; and there is also a small ferruginous dot on the middle of the forward margin, and a slight line opposite to it on the posterior margin. The basal third of the anterior wings, including all the space inside of the inner band except upon the forward margin, is of a leaden-brown color. In most specimens, however, (fig. 1) the several marks above described are obliterated to a greater or less degree. A pale brown inner band, three spots in the middle of the outer band, the middle one larger, with a brownish dash opposite them on the anterior margin, and on the hind wings one or two pale spots forward of the middle of the outer margin, are the only obvious marks commonly presented. And in yet other specimens, these spots are faint, and the inner band entirely disappears. The under side of the wings is similar to the upper, but in most cases more copiously marked with leaden brown, the entire basal half of the wings, except on their anterior margins, being here overspread with that color, traversed with light yellowish lines upon the nerves. The outer band of spots also, is here often very perfect when it is nearly obliterated upon the upper side.

The *antennæ* are more than half the length of the body. In the males (fig. 8), they are strongly bi-pectinated to their tips, the robust branches which issue from near the apex of each joint on each side, being furnished with minute hairs or bristles, of which those on the anterior side of each branch are longer and more erect. In the females, they at first view appear to have a row of processes, somewhat like the teeth of a saw, projecting upon one side only (fig. 10); but when carefully turned, to bring the face of the antenna fully in view, a corresponding row of teeth is exhibited upon the opposite side (fig. 9), showing that these organs in this sex are bi-serrated. Indeed, they only differ from the male antennæ in being destitute of the lateral branches or pectinations, the main stalk of the male antenna being bi-serrated, or showing a projecting tooth on each side of the apex of the joints, the same as in the female.

The *palpi* (fig. 7), enveloped in scales to their tips, project moderately forward and upwards, being obvious to the naked eye, in a dorsal view of the insect (figs. 1 and 2).

The *proboscis* (fig. 7), when uncoiled, is fully half as long as the antennæ.

The *tibiæ* (fig. 11), are furnished with spines or spurs on their inner sides, as in other geometridæ ; the anterior pair having one only, which is inserted near the middle, and so incumbent and immersed among the scales as to be distinguished with difficulty. The intermediate tibiæ have a pair of spurs at their apex ; whilst the posteriors have two pairs, one at the apex, and the other at about a third of the distance from these to the base.

The *Larva* (figs. 3 and 4), when fully grown, is eight or nine-tenths of an inch in length, and slightly over one-tenth in diameter, of a cylindrical form, distinctly showing the thirteen segments of which it is composed. Its ground color is a light lively yellow, which forms a continuous line or stripe along the middle of the back, another stripe rather low down upon each side, and still another below this. There is an irregular, white, cloud-like spot on each side of each segment, mostly between the dorsal and lateral yellow stripes, but prolonged downwards across the latter to the under side of the body. Numerous deep black spots and dots occupy each side of the body, which may be enumerated as follows : 1st. A regular row along each side of the yellow dorsal line, equidistant from each other, two being upon each segment, placed, with the corresponding ones opposite them, at the angles of an imaginary square. 2d. A smaller round spot on the anterior edge of each segment, slightly below those already described. 3d. Along the upper side of the lateral yellow stripe, a row of two spots on each segment, whereof the anterior one is large and the most conspicuous of any, and has a short black line immediately forward of it ; these two spots, with the two above them in the row first described, also form the angles of an imaginary square, within which the white cloud-like spot previously mentioned is chiefly situated. 4th. Close to the lower edge of each of the large spots just noticed, is a well-defined black dot, which is the spiracle or breathing-pore ; and slightly backwards and downwards from this is a round spot, nearly of the size of those in the rows first noticed. 5th. At the lower edge of the lateral yellow stripe, is a row of large, irregular shaped spots, two on each segment, somewhat confluent, forming as it were a black stripe. 6th. Below this stripe are four or more dots on each segment, less regularly arranged and constant than those above, and leaving below them an immaculate light yellow ventral stripe. The head is white, the eyes, mouth, and a transverse spot above the upper lip, and also the three anterior pairs of feet, black. The

body is slightly wrinkled transversely, and from each of the black spots upon it, a short black hair arises.

The *Pupa* (figs. 5 and 6), is somewhat variable in size, but it is about half an inch long, and sixteen-hundredths of an inch broad. It is of a shining-black, or very dark chestnut-brown color, and paler at the sutures. The dorsal and abdominal segments are thickly punctured. The tips of the wing-cases reach nearly three-fifths of the entire length, and their surface faintly shows some slightly elevated lines, formed apparently by the nerves of the inclosed wings. The abdomen terminates in a short, projecting, bifid point.

Explanation of the Plate.

Fig. 1. The male Currant-moth.
2. The female.
3. The larva ; lateral view.
4. The larva ; dorsal view.
5. The pupa ; ventral view.
6. The pupa ; lateral view.
7. The head, lateral view, magnified, showing the palpi, spiral proboscis, &c.
8. Joints of the male antenna, highly magnified.
9. Joints of the female antenna, highly magnified, facial view.
10. Joints of the female antenna, highly magnified, lateral view.
11. Anterior, middle, and posterior legs, magnified.

AN ESSAY ON THE ADVANTAGES OF AGRICULTURAL SOCIETIES TO THE FARMING COMMUNITY.

BY D. A. OGDEN.

Agriculture as a profession, stands in advance of all others in point of dignity and importance. It is the most ancient, the most useful, and in its influence, exercises the best and most conservative influence over the physical and moral good of community at large. Its practice is directly promotive of health and virtue, and upon its productions the world depend for food. To subdue and cultivate the earth, and to watch over and tend the flocks and herds which subsist upon her rich grasses, and sport over her green fields, was the first, and seems the best as well as most natural occupation of man. The father of his country has pronounced it, "the most healthy, the most useful, and the most noble occupation of man."

The Earth has received the significant name of mother, a name alike indicative of its nature as well as the duty of those who subsist upon it. To whom does man from infancy to age cling with so much real affection and esteem, whom does he so warmly cherish, so much delight to please and honor, as his mother? If then the Earth be the common mother of us all, is she not entitled to our regard, and are we not bound to nourish, protect, and by generous treatment, exalt, honor, and provide for her! From her bosom comes forth nourishment for all, from her abundance all are fed and clothed; she has a never-ceasing productive power; and when kindly treated and properly cared for, she never fails to reward the labor of her sons with rich harvests, and to gladden their hearts with the beautiful flowers of the field, and the lovely foliage of shrub and tree.

The proper business of the husbandman is to study the nature, and seek to become well acquainted with the disposition, powers and

Trans. N. Y. State Agricul for 1849

A HISTORICAL, TOPOGRAPHICAL & AGRICULTURAL SURVEY OF THE COUNTY OF WASHINGTON.

Taken under the direction of the New-York State Agricultural Society,
BY ASA FITCH, M. D.

[The first portion of this work, on being put into type, has been found to occupy so much more space than the writer had supposed it would do that he has been led to depart from his original design of pursuing the several topics in consecutive order, that he might first complete those branches to which this Survey mainly has reference. As the several topics to be reported upon are measurably distinct and independent of each other, the succession in which they are presented becomes a matter of minor consequence. To fully report upon every subject is obviously impracticable. It has therefore been deemed specially important that in those industrial branches to which attention is most prominently directed in this county, and in which it occupies a leading rank, a full account should be rendered; whilst in those branches in which other counties of the State are in advance of this, a cursory notice only, from this county, will be required. And overburdened with matter as the present volume of Transactions is, the following articles only are now submitted; the sections being numbered onwards from last year's volume, for the purpose of more convenient reference in a final index.]

PART SECOND.

SHEEP HUSBANDRY OF WASHINGTON COUNTY.

106. *Adaptedness of this county to fine wooled sheep.*—No section of our country can be better adapted for the convenient and profitable keeping of fine wooled sheep than the eastern half of Washington county. From the Bald mountain range of hills on the west to the state line on the east, almost every farm contains a portion of interval or permanent meadow from which hay for winter consumption is gathered; and the remainder consists of hilly upland, yielding a short, sweet nutritious grass for summer pasturage. To the west of this tract, the level lands towards the Hudson river furnish no such pasturage; and to the east of it, in Vermont, the lands become more broken and mountainous, with no intervening valleys supplying the requisite amount of meadow lands.

Most of our hills it is true are susceptible of cultivation to their summits, and at the present period, would be more profitable if given up to tillage. But although the prices of wool render its production little lucrative, it can here be grown to such advantage, that these hills now are covered with flocks, and it is probable they will so continue in all coming time.

107. *Wool statistics of this and other counties.*—Eminently adapted as this county is for the keeping of sheep and the growth of wool, this has been during the past twenty years the leading and prominent business of the county. And the quantity and quality of this staple here produced, is probably unrivalled in any other section of our land.

Of thirty-six million pounds of wool grown in the United States, according to the returns of the last national census, 9,845,295 were produced in the state of New-York, and next to us stands Vermont, yielding 3,699,235 pounds.

The state census of 1845 furnishes us with the following statistics of the sheep husbandry in the five counties of this state that rank highest in this branch, and also in the counties of Dutchess, Rensselaer and Columbia, whose local situation, and whose reputation in the wool market associates them with Washington county. In addition to the returns given by the census, a column is appended, showing the average weight of the fleeces in each county, this being a pretty accurate indication of the fineness of the wool; and also a column showing the average number of sheep to every hundred acres of cleared land in the county.

COUNTIES.	No. of sheep over one year old.	No. of lambs.	No. of fleeecs.	Pounds of wool.	Av'ge wt. of fleeces. lbs.	oz.	Sheep to 100 acres.
Washington, ...	199,311	66,746	202,848	579,056	2	14	64
Madison, ...	190,043	78,278	187,840	571,274	3	1	71
Ontario, ...	187,608	70,326	193,557	630,739	3	4	61
Otsego, ...	182,122	75,542	187,782	548,868	2	15	46
Chautauque, ...	163,495	69,220	160,255	485,826	3	¼	64
Dutchess, ...	139,797	61,693	147,928	471,096	3	3	37
Rensselaer, ...	118,884	45,608	122,021	375,902	3	1	42
Columbia, ...	109,906	52,660	117,580	352,739	3	0	32
State of N.York,	4,505,369	1,870,728	4,607,012	13,864,828	3	0	38

108. *Relative fineness of the wool.*—It appears from these statistics that the reputation which this county has so long enjoyed in the wool market, justly belongs to it. In the fineness of its wool it surpasses all the other large wool-growing counties of the state. And one county only, produces a greater amount of wool than Washington, namely, Ontario; and the wool of that county is evidently of a coarser quality than that which is here grown, as is clearly indicated by the fact that the fleeces there are on an average six ounces heavier than they are with us.

These returns make the average weight of the fleeces of this county to be two pounds and fourteen ounces. But this, it is quite probable, is somewhat heavier than they actually are. Almost every man is prone to over-estimate the amount of his clip, and is annually disappointed when it comes to be weighed, to find the fleeces so light as the scales declare them to be. Those who have been extensively engaged in purchasing the wool of this county for several years, and have thus become familiar with its weight, think that two pounds and three quarters is about as high as the fleeces will average.

109. *Discrepancy between the number of sheep and of fleeces.*—There is quite a discrepancy in the census returns above cited, between the number of sheep reported and the number of fleeces. Thus, in this county, thirty-five hundred more fleeces are reported, than the number of sheep which we had; and a similar excess is shown in several of the other counties. This I suppose has been caused by tho unsold clip

gratify their vicious propensity, and return home ere daylight. It is thus often difficult, for a time, to detect the real culprits.

DISEASES OF SHEEP.

156. *Scab.*—We proceed next to adduce such facts with regard to the diseases with which sheep in this district are affected, as are within our knowledge. These diseases are chiefly cutaneous affections and maladies which result from the attacks of insects. Of the former, one of the most common is the Scab, as it is termed. This has prevailed much more with the Vermont flocks than it has with us. It is a contagious disease, analogous to the itch, and is the worst when the fleece is most heavy, namely, in the spring and fore part of summer. To appease its torment the sheep bites and scratches and rubs itself, starting out the wool; and if not attended to, it eventually dies, the disease in the meantime spreading through the whole flock. The skin is inflamed and rough, and is covered here and there with pimples which discharge a fluid, and become crusted over with a scab. It is cured by thorough washings with decoction of tobacco.

157. *Johnswort poison.*—It is a common opinion that the green and growing leaves and stalks of Johnswort (*Hypericum perforatum*, Linn.) a weed which fortunately is much less common in our fields now, than it was fifteen years ago, by their acridity produce a soreness and inflammation of the noses of sheep in consequence of rubbing against them. But some experienced observers say they have never seen such an effect, except perhaps in lambs. The most serious injury of this poisonous weed is that which it produces upon the skin of the body. When sheep in spring are turned into a field where the dry dead stalks of the last year's growth are still standing the seeds often get into the wool and work down through it to the skin, there producing sores similar to those of the scab. These should be dressed with an ointment made of lard mixed with about one-sixth part of tar. Where sheep are beginning to be poisoned by running in Johnswort pastures, the wool of each should be parted along the back and a streak of this ointment rubbed on the whole length. It will then work down over the body and preserve the sheep from becoming affected by the poison.

158. *Sun-burnt backs.*—Among other objections to the finest wooled, delicate, Saxony sheep, that were brought into the country twenty-five years ago, was this—their lambs when first yeaned had such thin wool and a skin so tender that they were unable to withstand the rays of the sun, even in this high latitude. Within a few days after birth if it was clear weather, their ears would become enormously swollen and red, hanging down by the sides of their heads, blistered as it were, and

translucent; and the whole back would become highly inflamed and sore, scabbing over and peeling off, bringing the wool with it and leaving the surface bare. Greasing the backs with lard was the practice to mitigate and cure this; but the better plan was to prevent it, which was effected by blanketing the lambs. A little experience enabled one readily to recognise these peculiar thin wools and tender skins as soon as they were born, and it was the practice of some, into whose flocks they became introduced, to sew on to them a piece of woolen or cotton cloth so securely that it would remain about a fortnight, by which time the back would become sufficiently tough to withstand the rays of the sun. Full grown thin-wooled Saxons after shearing are also liable to have their backs become burnt and excoriated by the sun in a similar manner; and to prevent this it is necessary that they should be anointed in the same mode at shearing time.

159. *The sheep-tick.*—By some popular writers this insect has been supposed to be a true tick, of the old genus Acarus, and we hence meet with it in books, referred to as being the *Acarus reduvius* of naturalists, a tick which infests cattle and dogs. It is probable that by the common name of this insect and by the circumstance that it does not possess wings, these writers have been misled to refer it to a place very far from where it really belongs. This mistake requires correction. The true ticks and mites have eight legs, like the spiders, with which they are accordingly classed in systematic works. This insect, however, has six legs only, and consequently belongs among the true insects.

At the close of the two-winged flies which constitute the order DIPTERA, is placed by naturalists, a small group named HIPPOBOSCIDÆ, the subjects of which constitute a connecting link between the true insects and the spiders. They have such a striking resemblance to spiders, that they are known in some countries by the name of "spider-flies." They differ from all other flies, notably, in some points of their organization, and in their habits. Though furnished with wings, it is seldom if ever, that they use them, for they do not fly abroad like the other insects of this order, but are parasites, passing their lives upon particular quadrupeds and birds. By means of the forked claws with which their feet are furnished, they are able to cling securely to the hair or feathers of these animals, and to run about among them with rapidity, and also to fasten themselves to the skin, piercing it with a sucker, through which they receive their nourishment.

Several of these flies are found upon the animals belonging to this continent. If an owl is killed in mid-winter, there will sometimes be discovered wandering about upon its feathers, or in the vicinity where its body is laid, a fly, which is the more observed from its being abroad

at this inclement season of the year. It is of a lurid-yellow color, the legs and under side of its body paler, and its wings of a slight smoky tinge expanding to the width of eighty-five hundredths of an inch when spread apart. It seems to differ in no very obvious particular from the *Ornithomyia avicularia* of Europe. Whoever has observed one of these flies, will have been struck with the resemblance which exists between them and the well-known sheep-tick, except that they are furnished with wings.

A larger species of these spider-flies, the *Hippobosca Equi*, of Linneus, is of a yellow color, with wings of a slightly russet tinge. It infests the horse; but I am not aware that it has ever been discovered on this side of the Atlantic.

Remarkable in this family, on account of its not possessing any wings, is the sheep-ticks, *Melophagus Ovinus*. It is less than a quarter of an inch long, and varies in the shade of its color, from rusty brown, to dull yellow, the hooks of its feet being black. Its body and legs are studded with short bristle-like hairs of a blackish color. In addition to its being wingless, another remarkable anomaly is presented to us in the history of this insect, as well as that of other members of this family. It does not undergo those several changes of form which take place in other insects. It has no larva or maggot state. It is a pupa, and not an egg that is deposited by the parent, and the perfectly formed insect comes directly from this pupa. It resembles a smooth, glossy seed, of a chesnut-brown color, and a regular oval form, slightly flattened, and is scarcely fifteen hundredths of an inch. At the head end, a slight depression is observable, in which are two punctured indentations. These pupæ are always observed scattered around in the fleece, when the sheep are being sheared.

Ticks multiply on poor sheep, like lice on a sickly child or cow. They find a secure abode among the long dense wool of this animal, in which they ramble about with agility. They are always found in plenty at shearing-time. Many of them remain upon the fleece when it is carried to the store-room, and the shearer often finds one or more of them upon his clothes, or in his hair, sometimes several days afterwards, where, pressed by hunger, they in some instances attempt to pierce and obtain nourishment from his skin. Others remain upon the sheep after it is sheared, but by the removal of the fleece, their haunts are so broken up, that they forsake their old abode for the longer wool, which they now find upon the lambs. Hence, two or three days after shearing, the lambs will be found to be overrun with ticks, to their excessive annoyance, whilst the old sheep have became nearly or quite free from them. This affords the most convenient opportunity for destroying these parasites.

The lambs should now be got up, and be dipped in or washed with a decoction of tobacco—a cheap, inferior kind of which is on sale in most of our stores for this purpose. Some are in the habit of washing their entire flock in this decoction, on the days of shearing, and this is a more effectual, but also a more laborious practice. This narcotic at once destroys the ticks, and has never been observed to nauseate the sheep, in the least degree.

160. *Grub in the head.*—This is an affection which is caused by the larva or maggot of an insect belonging to the family of gad-flies (ŒSTRIDÆ) which is another group pertaining to the same order of two-winged flies (DIPTERA.) The Œstrides resemble bees more than flies, in some respects, being large insects covered with hairs which often form bright colored bands. They are among the most singular and anomalous insects that are known. All the other two-winged flies possess a trunk or proboscis through which they imbibe their nourishment. But the Œstrides are not only destitute of this trunk, but several of them have not the slightest vestige of a mouth—no opening whatever in the face by which to take in sustenance. It is in their larva state only that they receive nutriment; and in this state each species lives within and draws its nourishment from some particular quadruped of the herbivorous kind, none of them occurring upon the carnivorous. These larvæ have three kinds of domicils in the animals which they infest. Some are *cutaneous*, living in tumors in the skin of the ox, the deer, the rabbit, &c. Others are *gastric*, subsisting in the stomach of the horse. Others are *cervical*, living in the frontal sinuses of the sheep and the reindeer. No one can contemplate the habits of these insects without being overwhelmed with surprise, they are so truly wonderful. In each instance the parent fly selects for its eggs a nest appropriate for the wants of the young insects that are to hatch from them. And as is well observed by the celebrated French entomologist, Macquart, in this selection is shown a foresight and sometimes a chain of reasoning which excites our profound admiration, not for the insect, for to it it is impossible to attribute such forethought, but for that Supreme Intelligence by which it is prompted in its proceedings. How, for instance, can it be admitted that the bot-fly of the horse, an hour or two after it is hatched from the earth, knows all that it is doing, when after hovering some time in the air by the side of its victim, it deposits an egg upon his shoulder or else upon the inner side of his legs. Surely its own intelligence cannot inform it that that egg ought to be placed there so that the tongue of the horse in licking that spot will take off the young larva and draw it into his mouth and swallow it thence into his stomach, where its life must be passed.

As this group of insects is so deeply interesting, particularly to the farmer, some account of those species which most annoy our domestic animals may be given in this place.

The bot-fly of the horse being regarded as the type on which Linnæus founded his genus *Œstrus*, that name is retained for it by the latest naturalists, instead of the name *Gasterophilus* proposed by Dr. Leach. The most common species, *Œstrus equi*, Linn., is from a half to three-fourths of an inch long. Several specimens before me exhibit considerable differences in the details of their coloring. The thorax or middle segment of the body is black, the head and abdomen varied with brown, dull yellow and sometimes black, which last is the prevalent color of the exserted tip of the female abdomen. The body is covered with yellow hairs. But the most constant character by which to distinguish this species is the markings upon its wings, these being transparent, with a brown, smoky-like band across the middle and two spots of the same color at the tip. The pupa, as it has occurred to my notice, is half an inch long and a quarter of an inch broad, nearly oval but somewhat smaller anteriorly. It is of a black color, encircled with rows of short sharp spines or thorn-like points directed backwards, there being one such row upon each segment. On the anterior end are two little processes like horns. I have sometimes met with this pupa in the dung of the horse, the larva in these instances probably having been so far matured towards its pupa state when it was voided from the animal that it was unable to crawl into the ground as it usually does.

The *Œstrus nasalis*, Linn., is the name applied by the latest authorities to the species which has been current in books under the name of *veterinus*. This is of nearly the same size with the preceding, and has the head yellow, the remainder of the body being black. Hairs orange yellow; those of the abdomen whitish except on the third segment, where they are black; wings, hyaline. This and the preceding are the only species of bot-fly that infest the horse, that I have met with in this country, though it is not improbable that others exist. There is perhaps no part of the science of entomology where so great confusion has prevailed in the names and descriptions of the species as here, and the authorities are so discordant that it is difficult to determine which names are to be sanctioned as the correct ones.

The *Hypoderma Bovis*, Linn., or gad fly which produces the warbles on the backs of cattle, is of a size corresponding with that of the common bot-fly of the horse. It is of a black color and clothed with yellowish-white hairs, except on the third segment of the abdomen, where they are black. The wings have a brownish tinge.

The sheep gad-fly, *Cephalemyia Ovis*, Linn., is somewhat smaller than the species above noticed. Its thorax is grayish and is covered with little black tubercles, each of which bears a hair. The abdomen is white and in particular reflections of the light exhibits irregular black spots. The legs are yellow and the wings hyaline. This fly commonly lurks about the vicinity of woods, in the months of June and July. According to the accounts of it that we meet with in authors, it aims to get its eggs within the nostril of the sheep, and for this purpose darts upon it with the quickness of lightning, depositing an egg in the act. The warmth and moisture of the part speedily hatch this egg, and the little worm that comes from it crawls up the nostril until it reaches some of the cavities connected with the nose. It is said that this worm occasions great irritation as it crawls upwards, causing the poor animal to gallop furiously about, snorting violently, as if almost maddened by the annoyance. The worm commonly takes up its abode in the frontal sinuses. These are two large shallow cavities in the forehead, one on each side, directly above the eyes and the root of the nose. It here fastens itself, by means of two hooks with which it is provided, to the skin which lines these cavities, and there remains until April or May in the following year, the sheep experiencing no further annoyance from it after it attaches itself. Being at length fully grown, it loosens itself from its hold upon the skin and crawls out the same way by which it entered, again giving much annoyance to the animal, which makes most violent efforts to sneeze it out. Dropping to the ground, it burrows beneath the surface, and becomes an oval, motionless pupa, in which state it remains six or eight weeks, when, breaking asunder its its shell, it comes forth a perfect fly. Being destitute of a mouth it takes no food, and only exists a short time, depositing its eggs for another generation being its sole employment.

I am informed by my neighbor, John McDonald, that some years since a number of his sheep were observed in the month of April to be affected with a discharge of mucus from the nose. They lost their appetite, pined away and became quite emaciated, and about a half dozen of them died. On opening the heads of these, from one to six grubs were found in the frontal sinuses of each. I have never examined the heads of deceased sheep to find the larva of this insect, but have, in some instances, observed it dead in the mucus that oozed from the nostrils of the sheep, a day or two after it had died. And from this fact I infer that like other parasites, it leaves the body on which it has preyed when life has become extinct, and those larvæ that are suffi-

ciently matured, thereupon crawl into the ground and complete their transformations, whilst those that are immature perish.

That this fly is a most annoying pest there can be little doubt. A sheep will sometimes be observed to suddenly stamp and kick up both with its fore and its hind feet, as if stung by some insect, and will thereupon suddenly dart off at full speed towards another part of the field, as if to escape from its tormentor. But whether this is in consequence of its being assailed by the gad-fly is not certain. But to avoid the assaults of this insect the whole flock is often seen crowded together upon some bare, dusty or sandy spot, in the pasture, with their heads turned inwards towards the center of the group and held close down to the ground, one and another continually stamping with their feet as if to frighten away their enemy.

It is obvious that human instrumentality can be of little avail in protecting the sheep from this scourge. The inner side of the nostril being a secreting surface, it is impossible to coat it with tar or any other substance to shield it and prevent its being a suitable nidus for the eggs of the gad-fly. And to have the sod broken in some dry, dusty part of the pasture, and thus aid the animal in those efforts to which its instinct prompts it to resort seems about all that can be done for it.

161. *Maggots.*—The most deplorable casualties to which this innocent and valuable animal is subject, it may truly be said that it experiences from its insect enemies. In addition to the injuries which we have already considered, another still more calamitous and horrible remains to be treated of—that of being infested and consumed by maggots. These disgusting vermin, which rarely riot upon other animals until after life is extinct, not unfrequently make their assault upon this defenceless creature, as it were, before their time. Whilst it is yet in full health and vigor, they form a lodgment upon it, and rapidly multiplying, overrun its body, literally devouring it alive.

These maggots are the larvæ of several species of flies. That which is the most common one among them, is named by naturalists *Lucilia Cæsar*. This is about the same size with the common house fly, but of a brilliant brassy-green or blue-green color, and the legs black. It may always be observed abundant upon the bodies of dead animals in the fields in the summer season. And associated with it in such situations, is another species, *Lucilia Cadaverina*, which scarcely differs from it, except that it is a third smaller, with wings, exhibiting a slight degree of duskiness.

Another species is the blue-bottle-fly, *Calliphora Vomitoria*, Linn. This is much larger than either of the preceding, and is often seen buzzing about in situations where fresh meat is exposed. Its thorax is of a black or blue-black color, and the abdomen or hind-body deep shining blue. And a second species of the same genus, named *Fulvibarbis* by Robineau Desvoidy, closely resembles it, but is readily distinguished by the color of the bristle-like hairs at the base of the head below the eyes, which are here of an orange yellow instead of a black color.

These are the most common and best known European species of these carrion-maggot flies, but there are quite a number of others very closely allied to them, yet regarded as distinct by the naturalists of the present day. Our American species seem to differ scarcely, if at all, from those of Europe. A careful study, however, and comparison of foreign specimens with those of our own country, is necessary to determine accurately the number of our species, and whether they are really identical with those of the old world.

One of the most interesting traits in the habits of all the maggot-flies, is the unerring accuracy which the parent fly displays in selecting the appropriate nest for her offspring. Thus the egg of some genera are always placed upon decaying animal matter; others upon decaying vegetables, particularly mushrooms; and others still upon the dung of the cow-yard; the parent in each case choosing out the spot where her young will find that kind of nourishment on which alone it can subsist. From the eggs thus deposited, and which are commonly called fly-blows, the larvæ hatch. These are denominated maggots, in common parlance; and they accelerate the decomposition of the substances on which they live, so rapidly, that they seem to have been designed by the Author of Nature expressly for consuming such substances, and thus preventing them from tainting and poisoning the atmosphere by their effluvia, to the extent that they would be liable to do if left to decay gradually, and exhale all the gases that would be formed by their decomposition. When the maggots have arrived to maturity, they leave the substance on which they have been living, and crawl slightly into the ground, where they change into pupa of a chestnut brown or black color, and of a form resembling that of a barrel. Here in the earth they lie dormant during the winter, and on the return of warm weather the perfectly formed and fully grown flies hatch from them.

It is the species of the genera *Lucilia* and *Calliphora* more particularly whose larvæ subsist upon cadaverous matter; whilst those of the genus *Musca* live in dung-hills. In this last situation is cradled during its infancy that best known of all insects, our common house-fly, which Dr. Harris supposes may be distinct from the analogous species of Eu-

rope (*Musca domestiea*) and which he therefore names *Musca harpyia.* It is truly a harpy, appearing in swarms in the hottest period of the year, particularly in dwellings where the utmost neatness is not observed; impudently obtruding without invitation, and making itself the first seated guest at the dinner table, and ere grace is said, freely regaling itself from every dish upon the board. And the pertinacity with which a particular individual will often persist in travelling about our faces, or other parts of our bodies which are not covered with clothing, in order to drink up the perspiration which exudes from the skin, is often most annoying. Another species, also bred in the dung-hill, the *Stomoxys Calcitrans*, Linn., though it so exactly resembles the common house-fly, as to be popularly regarded as identical with it, is too voracious to thus content itself with the sanies that perspires from our bodies, but sucks the very blood of both man and beast, inflicting in this act a piercing bite that is most tormenting, particularly to the horse.

Though nature has assigned decaying animal matter to the Lucilian and Calliphorian flies as the domain in which their young are to be reared, as already intimated, they sometimes overleap their appropriate bounds and deposit their eggs in the ulcers of living animals, thereby causing these to swarm with maggots. And of all animals, the sheep, inoffensive and defenceless, is the greatest sufferer in this particular; and this is the case, alas, too commonly in consequence of the negligence and inattention of its inhuman owner. In warm weather, where ever upon a sheep the skin is fretted and abraded so that moisture exudes from it and a running sore is formed, it is sure to become the repository of the eggs of these flies. The following may be specified as the common causes of such sores and the consequent foundation of this malady.

1st. Bucks when kept together in the same field (as they necessarily are in most instances) become addicted to the habit of bunting each other; and an instance is related to me in which a valuable animal got his neck broken whilst indulging in this pastime as many are inclined to regard it. Frequently, hereby, blood or sanious matter is made to start out, moistening the wool around the roots of the horns. This wet wool becomes fly-blowed and the maggots thus obtain a lodgment here. Esq. Livingston who has had forty years experience, generally with a large flock, informs me that during all that time this casualty among his bucks has been the only thing of the nature of a disease, for which he has had occasion to resort to a medicinal application.

2d. Instances occur, though they are very rare, in which one of the horns at the end of its first volution grows almost in contact with the head, hereby pressing and matting together the wool between it and the

skin, causing it to become foul and to remain wet for sometime after a drenching rain. Thus the spot becomes adapted for the purposes of the fly, which thereupon makes it the repository of its eggs.

3d. When tagging the sheep is neglected, at time of turning them to grass, the filthiness that accumulates around the tail becomes such a source of irritation that some abrasion of the skin at length results from it and the sore is speedily discovered by the fly and appropriated to its use. So sure is this to take place among some of the flock that we have no sheep owners that I am aware of who neglect this most important operation.

4th. Maggots are an invariable sequel and the common cause of death in the foot-rot, as will be more particularly related under that disease.

In fine, whatever produces any sore from which moisture exudes is liable to result in this affection. Nay, one instance is related in which it was supposed to have originated without any abrasion of the skin. Some years since, Ebenezer McAllister, late of Salem, discovered that a number of his flock were infested with maggots. It was in the latter part of the season, just after a protracted period of rainy weather, and as the sheep had all been sound to appearance, it was supposed that the wool in consequence of having been so long wet, had become adapted for receiving the fly-blows. At all events there could only have been one or two of the sheep with slight and unobserved wounds in which these eggs were deposited in the first instance and the fleeces of the others being saturated with moisture the maggots freely crawled from one sheep to another when they were lying or standing in contact, so as to become extensively spread through the flock.

With regard to the treatment of this affection a few words will suffice. Removing the wool from around the ulcerated surface so that it shall no longer afford a covert for the worms, and pouring spirits of turpentine (oil of pine,) freely into the sore is the practice here universally resorted to. A few applications are effectual, in all cases where the malady is seasonably discovered. Where bucks are running together in warm weather their heads should be frequently examined and if there is any soreness or bloodiness about the base of the horns, spirits of turpentine should be applied. So watchful in this respect was the late Isaac Bishop that he made it a practice during warm weather to get his bucks up regularly once in every month and apply this medicine around the horns of all, indiscriminately, whether they were thus affected or not. Wherever this pungent oil penetrates, if maggots are there lurking, it instantly starts them out in evident agony—they hurry forth in-

to the ends of the wool, many dropping themselves to the ground, and others exposing themselves so that they are readily brushed from the fleece.

162. *Foot-rot.—How introduced into this district.*—The foot-rot is altogether the most severe and the most dreaded of any disease prevalent among the flocks of this district. Though it is now so common and wide-spread, it was unknown upon this continent, until it was introduced by the Saxon sheep. All the many cases of it that now exist in this section of the country, are believed to have been derived from a single diseased sheep, the history of which is therefore too important to be here omitted.

In the Autumn of 1827, Judge Campbell obtained a buck from the newly-arrived flock of Mr. Grove. It was a fine animal, and cost the purchaser a hundred dollars. A slight lameness was observed in one of its feet at the time of its purchase. This, Mr. Grove assured Esq, Campbell, was caused by a sliver or stub which had got into the foot. That Mr. Grove supposed the animal was wholly free from the foot-rot, no one who knew him, will doubt; and yet, it is difficult to conceive how a person so experienced in this disease, as Mr. Grove had been, came to be mistaken upon a point susceptible of being ascertained with such readiness and certainty.

The buck was turned with Esq. Campbell's flock, and ere long other sheep began to show the same lameness, and on the coming on of warm weather, the following spring, it fully developed its character, and raged with a virulence similar to the plague or yellow-fever when introduced into a populous city. Profoundly ignorant as our community was of the disease, and its mode of treatment, it advanced, unchecked, until it had pervaded the whole flock, and destroyed a number of its members. A youth living with Esq. Campbell at this time, going bare-footed into the field got some of the virus into a slight scratch that was upon his foot. It produced a most painful and malignant ulceration in the wound, and was at length cured by a resort to the same caustic application that was used upon the sheep.

Other flocks in the neighborhood, from being drove to the same pen to be washed, where Esq. Campbell's flock had been, and in other analogous ways, received the disease, and for a time it excited such consternation in Quassacook, and its vicinity, that the proprietors of sound flocks, scarcely dared to venture on to the public highway with their sheep, lest they should acquire the contagion. None of the other sheep obtained from Mr. Grove, communicated the disease to the flocks into which they were taken. Though it was known to be among his flock at the same time, he was careful to dispose of none but sound in-

dividuals. Judge Campbell commenced a suit at law against him for he damages he had sustained. The ablest counsel were employed upon both sides. Our whole community was excited, and took a deep interest in the subject. But the parties were men of too much discretion and good sense, to become involved in a course of litigation, from which both would probably be pecuniary sufferers in the end. The matter was therefore compromised ere it came to trial, Esq. Campbell receiving one hundred and fifty dollars from the defendant, and withdrawing his suit.

163. *The disease little cared about by some.*—From the single case above recited, the foot-rot has spread extensively through this district, and has been common since that time, though there are some neighborhoods to which it has never been communicated. Some of our farmers suffer it to linger for years in their flocks, and do not regard it as by any means, so serious a calamity as it is currently deemed to be. When at any time their sheep become badly affected by it, they resort temporarily to medication, which checks it; but they do not feel it to be worth their while to persevere in that medication until the disease is entirely eradicated. The owners of sound flocks, however, are always sedulous in guarding them from any communication with this disease. Little of it exists at the present time in those of our towns where the greatest numbers of sheep are owned. It is much more common to the east of us, in Vermont; and several who in former years were accustomed to hire pasturage upon the mountain-sides there, have abandoned the practice, in consequence of finding that their flocks were so liable to contract this disease when sent hither.

164. *Its predisposing cause.*—That this a contagious disease, communicated by contact with the matter that has discharged from the sores of affected sheep, there can be no doubt; and it is surprising that there has been a disagreement among writers upon this subject. The opinion advanced by Mr. Dick, in a communication to the Edinburgh Quarterly Journal of Agriculture, and copied without note or comment, into some of our popular treatises on sheep, that the foot rot proceeds from sand and dirt, which insinuates itself between the crust and sole of the hoof, until it reaches the quick, and there excites the inflammation and ulceration, which constitutes this disease, we cannot but regard as purely hypothetical. Why did not the sand and dirt of the American continent sometimes insinuate itself into the soles of the native sheep, or the Merinos, which were so extensively introduced, fifteen years anterior to the arrival of the Saxons? Assuredly, if this disease is produced by the causes assigned by Mr. Dick, it would have been as

common in this country before the Saxon sheep were imported, as it has since been. But it is unnecessary to enter upon a discussion of this topic, inasmuch as there is but one opinion prevailing in this country respecting it. Facts in abundance might be adduced to show that this prevailing opinion is correct.

The predisposing, that is, the essential cause of this disease, is a virus, or poisonous matter, which is generated in, and issues from the sores upon the feet of diseased sheep, which virus, by coming in contact with the feet of sound sheep communicates the same disease to them. It is therefore a disease of identically the same class with the itch, the small-pox, &c., in the human race, the kine-pox in the cow, and the "grease," in the horse. In the foot-rot of sheep, it is the common, and no doubt the correct opinion, that this virus is communicated not immediately from the feet of the diseased to those of the sound sheep, but is discharged upon the grass, haulm, stones, &c., of the sheep-walks, from whence it comes in contact with the feet of sound sheep. How long this virus, after it is discharged from the sores in which it has been generated, will retain its energy, is an important question, upon which we possess no authentic information. It would seem, that exposed as it is to the atmosphere, to the light and heat of the sun, the rains and the night dews, it would be soon decomposed and rendered inert. But no one deems it safe to turn his sheep into a field where diseased sheep have been, the same season; and some, are even of the opinion, that the frosts of winter do not destroy the taint, and that there is therefore some risk in pasturing sheep where a disorded flock has had its abode the preceding summer.

165. *Its exciting causes.*—It is in the summer season that this disease mostly affects the sheep. During cold weather, except a slight degree of lameness, it commonly discommodes them but little. As warm weather advances, the lameness increases, and the ulceration and discharge of matter then becomes more active.

The foot-rot is most inveterate among flocks that are pastured upon low, wet grounds. Hence it prevails to a much more considerable extent upon the clay lands upon the west side of this county, and is there more obstinate and less readily cured than upon the gravel lands on the east side of the county. And in Easton, large and valuable flocks have sometimes been so badly affected, that their proprietors have been induced to sell them out entirely, and remain a year or more without any sheep, regarding this as the only course by which they could hope to obliterate the virus of this disease from their premises.

In dry summers, among flocks pastured upon mountain lands, this disease does not occasion much annoyance. But even here, it will spread and rage in a virulent manner, in damp, hot seasons. It consequently affects our flocks, much more seriously in some years than it does in others, warmth and moisture being the circumstances that have been observed as contributing to promote it in a notable manner.

166. *Its symptoms.*—Dr. James Rice, of Fort Ann, in whose flock the foot-rot has prevailed of late years in a slight degree, informs me that it is not a constitutional, but purely a local disease, in the medical sense of these terms. In other words, it is not attended with any fever, loss of appetite, or other disturbance of the system at large—that except a slight preternatural warmth, perhaps, in the leg, on the access of the disease, all its symptoms are confined to the foot alone. One foot only is commonly affected at the first, and it is rare that all the feet are diseased even in the severest and fatal cases.

The disease consists in an inflammation and ulceration in the sole of the foot, at the junction of the hoof with the soft parts, eating like a cancer and destroying the connection of the hoof with the foot. It commences upon the posterior or heel side of the foot and works forward towards the toe, the heel portion of the hoof becoming entirely sundered from the soft parts, so that it may be readily raised up, whilst the attachment anteriorly still remains sound; but eventually the whole hoof becomes severed and drops off. The ulceration is of a highly malignant character; fungous granulations, popularly called "proud flesh," shoot up, and it is what is commonly termed "an angry-looking sore." The matter which is discharged from it has a peculiar and most offensive smell, which, in doctoring this disease, is imparted to the fingers and remains upon them for two or three days notwithstanding the most thorough washing. This peculiar fetor is one of the surest diagnostic marks of the disease. A person who has once become acquainted with it will readily determine thereafter whether lameness in a sheep is caused by foot-rot by the sense of smell; nor does the organ of this sense require to be very near the affected member to perceive this odor, if it is present.

167. *Its termination.*—This disease is probably quite painful to the unfortunate subjects of it in all stages of its progress. At its first commencement it causes lameness, and this continues to increase, until with the advance of the malady the sheep is no longer able to endure the agony produced by standing erect. It lays itself down, never to rise more. Partly upon its knees, for two or three days it creeps around

a limited space to glean the few mouthsful of sustenance within its reach, and having gnawed this to the very roots, unable to stretch itself farther, the miserable object dies from starvation,

Much more commonly, however, its life is terminated in a different, but not less pitiable mode. The fetor of the sores upon its feet attract to them numbers of flies. These deposit their eggs in the sores. From these fly-blows, maggots are hatched which throng the sores as thick as they can be crowded. Moreover when the sheep lies down for repose, its feet are naturally placed under it, in contact with its body and always touching the same spot. The wool growing upon this spot becomes hereby impregnated with the matter which issues from the diseased foot; and after a time a portion of the maggots forsake the foot and make a lodgment upon this spot, nestling in contact with the skin and sheltered and concealed amid the wool. Their abode here at length becomes obvious by a spot, it may be the size of a man's hand, appearing externally as if the fleece was there wet or saturated with grease, and on examination it is found that the wool here is loosened from the skin and is pervaded by myriads of maggots. This spot rapidly increases in size, and the maggots at length become so excessively multiplied that numbers scatter themselves abroad, crawling through all parts of the fleece, producing a degree of irritation and torment that soon puts a period to the life of the animal.

168. *Its treatment.*—It is surprising that farmers, and even good farmers, that are humane and choice of their flocks, can tolerate a disease that is liable to produce such results, when by suitable care it is well known it can be perfectly eradicated. Was every flock owner to do what duty and humanity calls for in this matter, this disease would soon become extinct in our country.

A number of receipts for the cure of this disease have been given in agricultural publications, most of them there is little doubt depending for their efficacy upon a single ingredient, which enters largely into their composition. This ingredient is blue vitriol (sulphate of copper,) and there seems to be no good reason for combining this with a half dozen other substances and making a complicated recipe, the virtue of which depends after all upon this one article. Other caustics are perhaps as good as this; but this having been amply tested and its efficacy clearly ascertained, there is no occasion for searching further, or trying to find out with how many other articles this can be combined and still retain its power. Every intelligent physician endeavors to make his prescriptions as simple as possible, and when he has one article that he knows will answer his design effectually, he avoids lumbering that arti-

cle with others that can in no wise increase the certainty or speed of its operation. It is the empiric only, that, ignorant of diseases and their true remedies and firing at random, puts a handful of shot into his gun with the hope that some one of them will hit the mark.

The best time to extirpate this disease from a flock is the fore part of the season. When the sheep are got up to be tagged, their feet should be carefully examined. Every one that exhibits the slightest ulceration at the root of the hoof, giving off that offensive fetor peculiar to the foot-rot, should then be separated from the rest of the flock. A person acquainted with this disease can tell with certainty every sheep that is affected by it. As this examination is making, spirits of turpentine should be poured into the clefts of the feet of all the sheep ascertained to be sound, in order to wash out and destroy any particles of the virus that may be lodged there. This will secure the unaffected members of the flock from having the disease break out among them. The diseased sheep must henceforth be kept by themselves, until the whole are cured. To effect this cure the hoof must be cut away so as to freely expose all of the diseased part. This is an indispensable part of the treatment. It can commonly be performed without putting the sheep to any severe suffering. But sometimes the affected parts are sore and tender, and if the point of the knife accidentally touches the quick, the sheep may get to struggling so violently that it will be necessary to tie its feet to complete the work in hand. Apparent cruelty here, is mercy to the animal in the end. The foot, moreover, in some cases gets to bleeding so profusely that it is impossible to see whether the whole of the hoof over the sore is removed; the timid operator often hopes he has exposed the whole of the diseased part, and desists when his object is but partially accomplished; and he hereby is under the necessity of renewing it at a subsequent day.

The hoof being pared away so as to expose the whole extent of the ulcer, blue vitrol alone or in combination with other substances is to be applied to its surface. G. Campbell informs me that the dry powder, formed by pulverising this salt, freely dusted over the sore, is all that is necessary, and is as efficacious as any application can be; the sore being hereby entirely healed over in a majority of cases, within about five days, and a perfect cure accomplished. Others, in addition to dusting with vitriol powder, pour spirits of turpentine upon the sore, but I doubt whether this contributes anything towards the cure. It will, it is true, repel the flies from depositing their eggs here; but if the vitriol alone excites a healthy action, causing the sore to heal so speedily, there can be little danger of the exposed part becoming the nidus of maggots in the interim. If it is preferred to have this medicine in the form of a

wash instead of a dry powder, the formula of the late Mr. Grove, which has been used by many in this vicinity and is known to be perfectly efficacious, may be followed. It is this. Blue vitriol, four ounces, verdigris (Acetate of copper) two ounces, dissolved in a junk bottle of urine. No one, however, who is conversant with the *materia medica*, will be inclined to regard the verdigris or the solvent as imparting anything to the value of this prescription. A saturated solution of blue vitriol in water, that is, about four ounces to a pint, there is scarcely a doubt will be equally efficacious, if not more so, in consequence of being free from any extraneous matter.

The essential feature in the treatment of this disease is, that every part of the sore be touched with blue vitriol or some caustic analagous to it. In order to insure its application to the whole extent of the diseased surface, it is indispensable that the hoof should be cut away so far that this surface will be fully exposed and can be got at with facility. A single application of the caustic in most instances, cures the disease. After a week has elapsed, however, some of the sheep will be observed to be still lame. The worst cases are so inveterate, with the fungous granulations of the sore so exuberant, that a second and in instances a third application of the remedy is required. And it is not unlikely that the feet of some of the lame sheep when they come to be examined the second time will be found to be entirely healed and perfectly well to appearance ; but on carefully paring off more of the hoof, the operator finds some of the old sore still existing, which had not been reached by the knife and the caustic in the first instance. He thereupon proceeds again to cut away the hoof sufficiently to expose all the remaining extent of the sore, and applies the vitriol to it as at first.

This course of treatment must be perseveringly followed up so long as the slightest indication of lameness is perceptible in any individual of this diseased lot. And they should thereafter be continued apart from the other sheep until the proprietor is perfectly sure that there is no vestige of the disease lurking among them to again break forth and spread through the flock. Thus the disease may be infallibly eradicated.

A person thoroughly experienced in this disease, but now out of the wool growing business and therefore disinterested in this matter says, if he was purchasing a flock of sheep, he would be willing to take diseased ones for twenty-five cents per head less than what sound ones are worth, so certain is he that every one can be cured, at an amount of care and expense equivalent to that sum.

159. *Black-foot or fouls.*—There is an opinion somewhat current among us, that there is in addition to the foot-rot another species of

lameness to which sheep are subject. This is here named the "black-foot" and is probably the same affection which is designated the "fouls" in Mr. Morrell's valuable work, (The American Shepherd,) and which is also briefly alluded to in Blacklock's Treatise, without any name. Nothing very definite respecting this disease is given in books, and the information I am able to gather in this district is far from being full and satisfactory. According to the current accounts it is a lameness similar to and frequently confounded with the foot-rot although it is entirely distinct. It is sometimes so severe that the sheep does not attempt to stand upon its feet, but hobbles about upon its knees and feeds in a recumbent posture. It is caused by pasturing on lowlands and disappears spontaneously and without any medication on removing the flock to dry, mountain lands. It is said that instances have occurred in which sharpers acquainted with this disease have taken shameful advantages of those who were ignorant of it, and have obtained valuable flocks at a great discount, the owners supposing them to be dangerously diseased with the foot-rot, whereas the more knowing purchasers by merely driving these sheep to a mountain pasturage in Vermont, have at once restored them to perfect soundness.

CONSUMPTION OF WOOL IN THE COUNTY.

170. *Woolen manufactories.*—A few statistics showing the extent of the manufacture and consumption of wool within the county, remain to be given, to complete the history of this branch of our industrial pursuits.

There are thirteen woolen manufactories in operation in the county at the present time; one at Union village, and another on Indian river in Granville, having been burned within a few years past, and not yet re-built. An establishment intended for a larger business than any of those now in the county, has been erected the past season (1849) at Fort Miller, but is not yet in operation. The location of those factories now in operation, and the amount of wool annually consumed by each is about as follows:

On White Creek, at White Creek village,		consuming	9,000	pounds.
On Owl Kill, near North White Creek village,		do	4,000	do
On Batten Kill, at Eagleville, in Salem,		do	20,000	do
do	Shushan, in Salem,	do	15,000	do
do	Clapp's Mills, in Salem,	do	10,000	do
do	East Greenwich, in Jackson,	do	35,000	do
do	Galesville, in Easton,	do	30,000	do
On Moses Hill, at Argyle village,		do	10,000	do
On Hudson river, at Sandy Hill, in Kingsbury,		do	10,000	do
On East Creek, at South Hartford village,		do	10,000	do

cess, and am now enabled to produce a winter seed crop, which furnishes a splendid flax, more silk-like than any other, as the sample No. 1 shows.

a. Besides it has the advantages to be sown in the fall, not subject to be sown either too early or too late, as this is often the case with the spring seed, and has always a failure of the crop in its train.

b. That the winter seed shoots sooner, yet before the weeds come out, which latter are kept back by it; it is earlier ripe, and can be brought in before the hands are wanted for other agricultural operations.

c. In order to prevent the shooting in the fall, the seed must be worked in by the plow as late as possible, and then the seed is not damaged neither by twenty degrees of cold (Reaumur.) In the spring, as soon as the field is dry, it must be lightly harrowed. It shoots with the first rays of the warm sun, and is already in flower when other spring seed is sown, and before the insects can do it any harm.

d. This winter seed is glossy, but dark and mixed with black grains, yet all shoot. It is a great deal more oily than the common seed.

If you will indicate the means by which to forward it, I am ready to send you a sufficient quantity of this seed, of course without payment. I would be happy to enter in connexion and correspondence with you. Your answer you can send me by means of the Ambassador, by the Imp. Agricultural Society at Petersburgh, or direct by mail, addressed "Kurland, Liebau a Paperboff." I should like to have some seed of the Maclura aurantiaca; and also, at due time, some notices about your exhibition. I am at any time ready to serve you also with the seed whose weed furnishes the persiese powder for killing insects of all kinds.

LOON FALKERSABORF,

Member of the Scientific Committee in the Ministerial Domain of the Imperial Geographical, Natural, Philosophical, Historical, Horticolar and Ag. Soc. at St. Petersburgh, Moskowa, Finland, Caucasas, &c. &c. &c., and real, corresponding or honorary member in almost all the European States.

APPLE TREE PESTS.

Schonherr's Weevil and the Orchard Moth.—Asa Fitch, M. D., Salem, N. Y.

Salem, N. Y., June 30, 1853.

Hon. B. P. JOHNSON: My Dear Sir—The Michigan insects reached me in safety. They pertain to the weevil family (CURCULIONIDÆ), and are one of the largest of that kind of insects which we have in this country. They are the *Pachyrhynchus Schonherri*, so named by the late Rev. Mr. Kirby, in honor of the Swedish entomologist Schonherr, who has devoted a great deal of attention to this family of beetles, so noted for the injuries which they inflict, and who has published several volumes upon them. Mr. Kirby's description of this species may be found in the Zoology of the Northern Parts of British America, vol. iv, page 103. It also appears, from the short description given in Turton's System of Nature, vol. 2, page 264, to be the species named *Curculio Noveboracensis*, or the New-York weevil, by Forster; but not having Forster's work at hand, I am unable to speak decidedly. It is rather a rare insect, I should judge, for I have never seen but three specimens of it heretofore. One of these I captured in this (Washington) county, twenty years ago. The others were sent to me, one from Long Island, and the other from Rhode Island. Mr. Kirby's specimens were taken in Canada.

This weevil, though variable in size, is commonly over half an inch in length, and is about two and a half lines broad. It is of a gray color, produced by short whitish hairs upon a black ground. Upon the thorax are three white stripes, more or less distinct, and upon each wing-cover are four white stripes which are interrupted by small black spots. These marks will suffice to distinguish this from other insects. We have a long-horned beetle, the grub of which lives in pine timber—the *Rhagium lineatum*—which is much more common, and strikingly resembles this weevil in size, color and form, but is readily distinguished from it, by having a projecting spine, or tooth, on each side of the thorax.

Hitherto, so far as I am aware, nothing has been known respecting the habits of this weevil; and the facts mentioned by Mr. Wetmore, that it eats the young buds and tender twigs of the

apple tree, causing them to wilt and die, passing from one bud to another, and, when satisfied, concealing itself under a leaf, until prompted by hunger, it crawls forth to take another repast, are very interesting, and will not fail to attract the notice of the fruit culturist. When these insects are present in numbers upon a tree, perhaps the best mode to get rid of them will be to spread sheets under the tree, and then shake the tree, or beat upon it with a pole. The insects, thus disturbed, will drop upon the sheets, and may be gathered up and killed by throwing them into a kettle of boiling water. They may then be fed to the hens.

Should a favorable season, or any other cause, lead to its becoming greatly multiplied at any time, it is easy to perceive that this weevil would be a great pest in our orchards. And that it will become thus multiplied, now and then, in particular districts, I do not doubt, history will show—this being the case with nearly all of our injurious insects. Commonly, their numbers are so few, that no notice is taken of their depredations. But, at times, they become so excessively numerous, as to commit great havoc and prove themselves a terrible scourge. An instance of this has recently been communicated to me. The common May beetle of our country, *Phyllophaga quercina*, as it is named in Dr. Harris's Treatise on Injurious Insects, (a work by the by, which should be in the hands of every farmer, gardener and fruit grower, now that a new edition has rendered it attainable to all,) is seldom noticed as being a depredator at least in this section of the State. Milo Ingalsbe, Esq., President of our county Agricultural Society, informs me that upon his place at South Hartford, he has about seventy plum trees, which were splendidly in bloom on the 15th of May last, together with a number of cherry trees of several of the improved varieties. In the course of two nights afterwards, however, this May beetle suddenly hatched out in such astonishing numbers as to wholly strip these trees of their leaves, buds and blossoms, leaving many of them as naked as in mid-winter, and destroying all hopes of any fruit the present year.

But a still more remarkable instance of the excessive multiplication and consequent havoc caused by an insect not previously noticed, has occurred in this vicinity, since I received your letter. Indeed it surpasses every thing of the kind that has been hitherto experienced in this county since the date of its settlement. On the 19th instant, a man from Cambridge inquired of me whether I had observed the worms upon the apple trees, saying that all the orchards in that town were being stripped of their leaves. Next day, on going to my apple trees, I found the worm alluded to, upon all of them, committing great havoc; and a gentleman from Argyle informed me that within two and three days past they had been observed, overrunning all the apple trees there. Upon the 23d instant, the circuit court being in session in the village of Salem, I saw persons from most towns of the county, and learned that this worm was ravaging every orchard within our borders, without exception. Some idea of the value of our orchards and the amount of damage which this pest threatens to do us, may be formed from the fact, that two years ago, to supply the vacancies produced by trees that had perished, and to plant new orchards upon some farms, an agent from one single nursery disposed of young trees in this county, to the amount of $10,000. As it well may, therefore, this worm at present forms the leading topic of conversation in every circle, and our newspapers are giving notices of it in their columns. And the crude and erroneous notions that are being formed and circulated respecting it, show, in a most humiliating manner, the gross ignorance which pervades our country, upon topics of this kind. One gentleman tells me, that in a conversation with the most noted and experienced nurseryman in our county, they had mutually come to the conclusion that this worm had been bred by what in his neighborhood is termed "the little green insect." On inquiry, I ascertained that this little green insect, so called because they know no other name for it, was nothing more nor less than the *Aphis mali*, or Apple-leaf Louse. And the idea that this louse breeds these worms, is rather more wild than it would be to conjecture that fleas breed bed-bugs. One of our most intelligent and successful farmers, who sometimes wields his pen as well as his scythe and hoe, favored me with the *recherche* information, that this is the

"canker-worm"—at least, said he, it is the very same worm which was called the canker-worm in Connecticut, when I was a boy. Had my good friend asseverated that the moon was made of green cheese, he would scarcely have surprised me more. I overheard another gentleman, a graduate of one of our best colleges, recommending to another similarly educated citizen, to bore his apple trees, fill the hole with sulphur, and close it by inserting a plug "made from the wood of the same tree." Methought he ought to have added, that the hole should be made with "a silver bullet," or at least that this operation should be done "in the old o' the moon."

Friend Johnson, posterity will only need what I have above stated, to show them that mauger all our vaunted light and intelligence, in this, one of the most important branches of natural science to the farmer, and one of the most interesting departments of nature's works to every studious and inquiring mind, our country, at the present day, is sunk in Egyptian darkness. In diffusive information, so far as respects Entomology, we are lagging far behind the subjects of several of the monarchical and despotic governments of the old world. In Germany and Prussia, countries which are regarded as much less enlightened than our own, not merely is a professor of this science deemed indispensible in every university, and every agricultural seminary, but its rudiments are taught in all their primary schools. In this country, on the other hand, such a thing as a course of lectures upon this science, has never yet been delivered, except perhaps in one or two of our universities. Indeed much of the very foundation of this science, upon this side of the Atlantic, is yet to be laid. Whole groups and families of our insects have never yet been examined. We have not even names by which to designate a considerable portion of our species. Take this apple tree worm, for instance. It belongs to a family of insects, of which, in Great Britain, there are upwards of 300 species. Our own country, we may safely assume, contains at least double this number. And of our 600 American insects of this family, how many, think you, have been examined and described? So far as I am able to ascertain, there are *three* species *only!* In no other de-

partment of science is an exploration so urgently required, so loudly called for, as in this. Scarcely a week passes, but that one and another within the circle of my acquaintance, is coming to me with some insect which he has detected, preying upon some article of property; of which insect he is anxious to know the name, habits and remedies. Within the past forty-eight hours, one has brought me a worm which is infesting the roots of his squashes, melons and cucumbers, and has killed a large part of these plants in his and his neighbors' gardens; another has shown me some pea-pods, containing a worm which is devouring the young peas; a third has brought in some tomato plants, wilted and destroyed by a grub that has perforated the stalk; and a young lady has submitted to my notice some caterpillars, which she finds devouring her roses. Such facts forcibly show how much, how very much we need a thorough investigation of the Entomology of our country. It is indeed surprising that this branch of natural science, in an economical aspect second to no other in its importance, should have remained to this day so lamentably neglected. In that valuable series of volumes, the Natural History of the State of New-York, we are presented with a full description of every object in the animal, vegetable and mineral kingdoms, that exists within our borders—save only our insects. This most important hiatus remains to be filled, to complete that great work, and render it full and entire as it was designed to be. Each succeeding year is showing how urgently we need the information which this part of that work would furnish us. Why should its completion be longer delayed? The pecuniary loss which we shall sustain the present year, from this one insect which is now devastating our orchards, is probably greater than will be the whole cost of a survey of the insects of the State.

I have only space left to give you a short description of this apple tree worm, reserving a more extended account of it for a future occasion, when I shall have had opportunities for studying its entire history.

It is a cylindrical caterpillar, somewhat resembling a span worm. It has sixteen feet, and is scarcely half an inch long

when full grown. It varies considerably in its colors and marks, but is commonly of a pale yellowish or greenish hue, with a dusky stripe on each side of the back, running the whole length of its body. Above this, a narrower whitish stripe is more or less distinct, and along the middle of the back is a slender dusky stripe, between the whitish ones. With a magnifying glass some black dots, regularly arranged, may be seen along the back and sides, each dot having a short hair growing from it. The head is polished, and of the yellow color of bees-wax. Some worms are met with, however, having black heads. Whether these are a different species or not, can only be determined when the insect has attained its perfect state. They subsist upon the leaves, eating holes in them, and often devouring all except the coarse veins of the leaf. They also gnaw the young apples, causing them to wilt and fall from the tree. Our crop of apples for the present year is totally destroyed, and it is probable that many of the trees will die also, their foilage being wholly consumed, so that the trees look brown, as though they had been scorched by fire. When the tree is shook or jarred, many of the worms let themselves suddenly down from it, some to the ground, others suspended in the air by a fine thread like gossamer, which they spin. If it is menaced or annoyed when on the ground, with a wriggling motion it runs backwards and forwards with surprising agility. This worm evidently belongs to the family of leaf-rolling moths, (Tortricidæ); and some of these worms may be seen hid in a slight covert which they form by folding the edge of the leaf, or folding it in a cylinder, or drawing two leaves together with their cobweb-like threads. Most of the worms, however, do not attempt to form any such covering for their concealment.

When the worm gets its growth, it crawls away from the tree, and under some leaf or other slight shelter on the surface of the ground, spins a little, oval, paper-like cocoon, of a gray color, about 18-100ths of an inch long, and a third as broad, within which it changes to a pupa. Analogy teaches us that from this pupa will come a winged moth or miller, such as often flutters about our candles in the evening. This moth will lay its eggs upon the leaves or in the chinks of the bark of the apple tree;

from which eggs another generation of these worms will be hatched. Dry, hot weather, in the month of June, it is certain, favors the multiplication of these worms. Before they were observed, it was currently remarked that such a spell of sultry, dry weather as we then had, was never before known so early in the season. On the night of June 23d we had heavy thunder showers, and the next day few of these worms could be found upon the trees. And though they are still present (June 30th) their numbers are now greatly reduced. Query—will not drenching the trees with water from a garden or fire engine prove to be the most effectual way of ridding them of these worms.

On beating and shaking the apple trees, I have repeatedly seen a moth fly from among the leaves, which I have little doubt is the parent of these worms. It is a delicate, pretty little insect, measuring six-tenths of an inch across its wings when they are spread. Its fore wings are of a shining pale yellow color, coarsely freckled with darker orange-yellow spots. The hind ends of its wings are occupied with a broad band of a purple color, blended with orange, and towards the outer or costal edge with a pale yellow. This band is double the width upon the costal that it is upon the inner side of the wing, and its anterior margin is slightly hollowed or concave; and running parallel with the anterior margin is a curved stripe, of an orange color, often tinged with purple, extending across the wing, slightly forward of its middle. The hind wings are grayish-brown, and white anteriorly on the outer side. This moth pertains to the genius *Argyro-lepia*, and the sub-genius *Lozopera* of the distinguished British Entomologist, Mr. Stephens; and as this species does not appear to have been hitherto described, I propose to call it the *Argyrolepia pomariana*, the specific name being derived from the Latin, *pomarium*, which, translated, will give us for the common name of this insect, *the Orchard Moth*, or, if we wish to be more definite, the *Orchard Argyrolepia*.

Our forests at present are infested to an unusual extent with a worm so exactly like that in the orchards, that every body regards them as being identical; nor have I been able to detect any marks by which they can be told the one from the other. Still, it is

probable that they are distinct species. I have hitherto, in July and August, in different years, captured a moth in our forests, very like the Orchard Moth above described, and which I am inclined to regard as the parent of these forest worms. It is very slightly larger than the Orchard Moth; its fore wings are bright ochre-yellow, many of the scales sparkling with the lustre of burnished gold, and instead of being freckled, they are covered with crinkled, irregular, transverse lines of an orange color; the purplish stripe forward of the middle of the wings, is widened as it approaches the costal edge, and is prolonged upon this edge to the base of the wing; and posteriorly, instead of the broad band, there is only a spot of purple blended with orange, situated on the costal edge forward of the apex; the hind wings are white. In my collection, I have named this species *Argyrolepia sylvaticana* or the *Forest Moth*. We also have, in this State, two or three other species closely resembling those described, but I know nothing of their habits.

Yours truly, ASA FITCH.

P. S. *July 23d.*—Informed that the number of the Journal of the New-York State Agricultural Society for August, had gone to press when the above communication reached you, and that it could not, therefore, appear until the issue of the succeeding number, as it was a topic in which our community was much interested, and erroneous views were being imbibed, I handed a copy of it to the Salem Press, in which newspaper it was published on the 12th inst., and copies were mailed upon the following day, to my several agricultural and scientific friends throughout the country. A few days after it was written, from the cocoons alluded to, I obtained the winged moth, from which it was evident that the species of *Argyrolepia*, which I had described, was produced by some other worm, as yet unknown, which probably infests our apple trees; whilst the worm which has done so much havoc this season, instead of pertaining to the family Tortricidæ, as all its habits so strongly indicated, in reality belongs to the Tineidæ, the family which includes the clothes moths and other species which subsist upon fur, grease, and various other articles of household stuff, and which make cylindrical burrows through

the substances on which they feed, and have other habits, in the main very unlike those of this apple tree worm. The winged moths which this apple tree worm produces, belong to the genus named *Chætochilus*, by Stephens and Westwood, *Rhinosia*, by Treitschke, *Ypsolophus*, by Curtis, and *Aneychia*, (probably), by Hubner. Which of these several names was first published, and therefore has the right to be retained for our insect, I have not at hand the means for ascertaining; the name of Treitschke, however, must be rejected, Mr. Kirby having long since given the name *Rhinosia*, to a genus of weevils. The insects of this genus are chiefly distinguished by having their feelers clothed at base with very long scales, which project horizontally forward from the head, resembling a beak, and from the middle of the upper side of these scales, the last joint of the feelers is protruded upwards like a spur.

I had prepared a description of this moth, to be appended to the account which I had already given, but have to-day received from Dr. Harris a slip of a newspaper communication, dated the 19th inst., in which he names and describes it, from specimens which he has recently reared from some of the worms sent to him. He names it *Rhinosia pometella* (from the Latin *pometum*, a synonym of *pometarium*) or "The little Rhinosia of the orchard." But, for the reason above stated, I think we must adopt Mr. Stephens's generic name, and call our insect *Chætochilus pometellus*. Dr. Harris describes the species, as follows: "Forewings ash-gray, sprinkled with blackish dots, three of which, larger than the rest, are placed triangularly near the middle, a dusky, transverse band near the tips, and a curved row of seven black dots at the origin of the terminal fringe. Hind-wings, dusky, with a leaden lustre, black veins, and very long black fringes. Body and legs beneath, yellowish-white, with the lustre of satin. Expansion of the wings, five-eighths of an inch."

This description applies with sufficient exactness to the insect, which, however, is subject to great variety. I have a host of specimens before me, reared from the worms, and captured upon the wing every where in our orchards and forests, since the first week of the present month. On the 8th inst., a large white oak

tree was observed, wholly stripped of its leaves, save merely a few fragments upon some of the lowest limbs; and at every step taken among the weeds and grass growing beneath this tree, a swarm of these moths would arise. An inspection of the several specimens in my possession shows that no two individuals are exactly alike in all their details. The general color of the fore-wings varies from tarnished cream-white to dark ash-gray, often with a pale purplish-red reflection, and mottled more or less with darker cloud-like spots of tawny yellowish-brown, which spots sometimes form four equidistant transverse bands There are often two larger black dots slightly forward of the middle of the wing, and two others half way from these to the tip; but these dots are sometimes indistinct or wholly wanting. The seven black dots in a semicircular row, at the base of the terminal fringe, are almost always present. The veins of the hind-wings are commonly darker than the general surface; the fringe is of the same color or sometimes lighter.

Associated with this species, both in our orchards and forests, may frequently be met with another moth of the same size and general appearance, and with its body and wings similarly colored and dotted, but having only the outer or costal half of the fore-wings of a dull cream-white or ash-gray color, whilst the inner half, the whole length of the wing, is of a brownish-black, the one color not shaded gradually into the other, but the transition being abrupt. I have named this the Comrade Moth, *Chætochilus contubernalellus*, from the latin *contubernalis*, a comrade. The worms which this moth breeds, doubtless infest the apple and other trees the same as those of the other species. As already intimated, I propose preparing a full account of these insects, at an early day. A. F.

Note.—A gentleman of Albany, who has a farm a short distance from town, discovered these worms upon his apple trees, having destroyed the leaves upon two trees. He procured some whale oil soap, diluted it with water, and with a garden engine thoroughly drenched the remainder of his trees, and they were entirely preserved from the ravages of the worms. J.

[Letter from Dr. Thaddeus William Harris.]

CAMBRIDGE, MASS., *July* 23, 1853.

Hon. B. P. JOHNSON: Dear Sir—I have read, with some interest, your communication, on some insects that are injurious to the buds and young twigs of the apple tree in Michigan, contained in the Journal of the New-York State Agricultural Society, for July, and also the reply of Dr. Fitch, and his account of other destructive insects, printed in the Salem Press, of the 12th instant.

On the 22d of June, P. Barry, Esq., the editor of "the Horticulturist," sent to me a beetle and an apple tree twig, with the following remarks: "A gentleman in Wisconsin encloses me the weevil and piece of apple tree which accompany this. He says they are very destructive to his apple and pear trees, and occasionally to his plum and cherry trees. They attack the branch, generally, at the base of a young shoot, and eat it to the pith. He thinks it must operate in the night, as he can not find it in the day. Have you seen it in Massachusetts?"

This large weevil is the *Ithycerus Noveboracensis* of my catalogue of the insects of Massachusetts, printed in 1835, or the *Curculio Noveboracensis* of Forster's Centuria, printed in 1771. It is, undoubtedly, the same species that is referred to in your communication, and in Dr. Fitch's reply. Though not a very abundant species here, it is by no means rare, and it seems to have a wide range through the country, being found in most of the New-England States, inthe Middle and in the Western States, in Canada and in Newfoundland. I have taken it in Massachusetts, on forest trees, particularly oaks, in June and July; but never met with it on fruit trees. Nothing is known to me of the habits of the insect in its early stages.

John Reinhold Forster, the first describer of this fine species, found it, as we learn from his "Catalogue," in "a most select and numerous collection of American animals, belonging to a lady in Lancashire." This lady was the celebrated Anne Blackburne, eldest daughter of John Blackburne, Esq., of Warrington, England. She received it, with other insects, from New-York, whence it was probably sent by one of her brothers, who resided in this

country. The specific name *Noveboracensis*, given to it by Forster, commemorates the place whence it came, and, having priority in point of time over other names subsequently given to the same species, must be retained. Gmelin, in 1788, and Olivier, in 1790, redescribed it under the same name.* It is the *Rynchites curculionoides*, of Herbst, who figured and described it in 1797, from specimens in a museum, rich in North American insects, belonging to Mr. Herschel, the court musician at Hanover, in Germany, a near relative of Sir William Herschel, the astronomer. In 1833, the Chevalier Schonherr, the author of an extensive work on the weevil tribe, gave it the name of *Ithycerus curculionoides*, unfortunately adopting the specific appellation bestowed upon it by Herbst, rather than the earlier one of Forster. Lastly, in 1837, Mr. Kirby, apparently not aware that the insect had already been made known, described it under the new name of *Pachyrhynchus Schonherri*, which must give place, as a synonym, to *Ithycerus Noveboracensis*.

By Monday's mail, I propose sending to you the Cambridge Chronicle of this date. You will find therein an account of the Palmer worm of New-England, which has lately done much damage to orchards in various parts of the country. I hear of it throughout the valley of the Connecticut, and nearly to the White mountains of New-Hampshire. It also prevails in the valley of the Housatonic, and as stated by my friend, Dr. Plumb, of Salisbury, and by Dr. Fitch, to a considerable extent in the valley of the Hudson. Should we have a second visitation of the insect during the present summer, orchards must suffer severely from its ravages. From the scientific name and description, which is given in the Chronicle, of the moth produced from it, you will perceive that the latter is a very different insect from the two moths described by Dr. Fitch.

Respectfully, your friend and serv't,

THADDEUS WILLIAM HARRIS.

* In 1781, the Danish Naturalist, Fabricius, having met with a specimen from Newfoundland, in the collection of Sir Joseph Banks, described it under the name of *Curculio punctatulus*.

THE PALMER WORM.

By Dr. Thaddeus William Harris.

During the month of June, a small worm, or naked caterpillar, has been observed on apple trees, in large numbers, throughout the greater part of New-England, and in the valley of the Hudson, in New-York. By some persons it was thought to be a new comer; and by others was mistaken for a second generation of the canker worm, which disappeared about the time that these smaller insects began their ravages. This, however, is by no means the first visitation of the insect in such unwelcome and destructive profusion. As long ago as the year 1791, it prevailed through many parts of New-England, during the month of June, and at that time received the name of the *Palmer worm*. Some account of its ravages in orchards, and even among forest trees, at that date, may be found under the head of *insects*, in the second edition of Dr. Deane's "New-England Farmer and Georgical Dictionary."

Communications concerning this insect, several of them accompanied by specimens, have been sent to me from Bradford, Andover, and Westford, Mass.; from New Boston and Keene, New-Hampshire; from New Haven and Salisbury, Conn.; and from Providence, R. I. Apple, cherry and plum trees in my own garden, also afforded me a few of the same insects, which were first observed there about the 10th of June. Within the past three weeks, numerous accounts of this supposed new or hitherto unnoticed depredator, have been published in all our agricultural newspapers. In some places, orchards have suffered from these insects in the same way and to as great an extent as from the ravages of canker worms; and in some cases, not only the leaves, but the young fruit has been destroyed by them.

These worms, or caterpillars, grow to the length of about half an inch. Though varying somewhat in hue, they are mostly of a pale yellowish green color, with two blackish lines along the top of the back, and a brownish head. Under a magnifier, a few short hairs can be seen on the body, arising singly from little black points, arranged in threes on each side of every ring; and there are usually two, more or less conspicuous, semicircular,

blackish spots on the top of the first ring. They have sixteen feet; the first three pairs being jointed, and ending with a point or claw, the others, fleshy tubercles without proper joints. They are very impatient of being touched, and on being taken into the hand, move with great agility, and by jerks, both forwards and backwards. When the trees are shaken, the insects spin down, and hang suspended by threads. Probably most of them leave the trees in the same way, when their course is finished. In some places, it was observed, that they all took their departure during heavy showers, towards the end of June. My official engagements, at that time, prevented my observing their progress abroad.

All the specimens sent to me, that remained alive, together with a few from my trees, were put into a wide-mouthed bottle, and were supplied with leaves. About the 28th of June, some of these worms began to cover themselves with a transparent web, formed of a few delicate silken threads. One of them was transformed to a chrysalis, within its web, on the 5th of July, and became a winged moth on the 9th; having remained in the chrysalis state only four days. Others were more tardy in their transformations; and one still remains a chrysalis. More than half of the whole were unable to take this form, having perished in the worm state, from the attacks of an internal parasite, a minute grub, which, after preying on the vitals of its victim, left the body and spun itself a little oval whitish cocoon or pod, from which it emerged soon afterwards as a tiny four-winged ichneumon fly.

The chrysalis of the palmer worm is only one quarter of an inch long. It is of a pale brown color, and differs from that of the common bud worm, in not having any transverse rows of teeth around the body. The moth is of an ashen gray color above, whitish, and lustrous like satin beneath. The fore wings are very narrow, and are sprinkled with a few black dots, three of which, near the middle, are larger than the rest. The hind wings are also narrow, blackish, and surrounded by very broad fringes. The antennæ are bristle-formed. The palpi, or feelers, project horizontally from the head, in the form of a brush-like snout, and

from the middle of the upper side of each of them, arises the curved and pointed terminal joint, like a little spur. The tongue is spirally rolled, and when extended, measures about half the length of the antennæ. This little moth rests with the fore part of the body slightly elevated, the narrow wings horizontally incumbent upon the body, and the antennæ turned backwards, and lying straight upon the wings. The insect may now be seen on the wing, in the evening, soon after sunset; and it may also be found in considerable numbers, among the grass, at a somewhat earlier hour.

A scientific name and character, with the classification of this moth, remain to be given. It belongs to a group or tribe called Tineadæ, and to the genus *Rhinosia* of Treitschke, or *Chætochilus* of Stephens. Most of the insects belonging to the above named tribe, are of small size, and have diminutive specific names, ending in *ella*. As this insect frequents the orchard (in latin *pometum*) it may be called *Rhinosia pometella*, the little Rhinosia, or the little Snout-moth of the orchard. From other species of the same genus, it may be distinguished by the following characters: Fore-wings, ash-gray, sprinkled with blackish dots, three of which, larger than the rest, are placed triangularly near the middle; a dusky transverse band near the tips, and a curved row of seven black dots at the origin of the terminal fringe. Hind-wings, dusky, with a leaden lustre, black veins, and very long black fringes. Body and legs beneath, yellowish white, with the lustre of satin. Length, from the forehead to the ends of the closed wings, five sixteenths of an inch. Expansion of the wings, five eighths of an inch.

Some hope may be entertained that the little parasites, alluded to in the foregoing account, may tend greatly to check the future undue increase of the palmer worms. Should a second generation of the latter appear during the present summer, or should we have another visitation of them next year, or at any future time, some means for arresting their depredations may become necessary. Showering the trees with soap-suds, or a solution of whale-oil soap, or with lime-water, dusting ashes or air-slacked lime on the leaves, when wet with dew or rain, or casting dry sand upon the trees, may be found serviceable. T. W. HARRIS.

Cambridge, Mass., July 19, 1853.

1853

INSECTS OF ALGIERS,

FROM THE

MUSEUM OF NATURAL HISTORY OF PARIS.

(Confided to Asa Fitch, M. D., for the Agricultural Society of New-York.)

Through Mons. A. Vattemare's International Exchange, we have received insects, hurtful to agriculture, from Algiers—136 species—correctly named, from Milne-Edwards, Esq., Senior of the Faculty of Sciences, Administrator and Curator of the Collection of Entomology, Museum d'Histoire Naturelle de Paris. When in Paris, in 1851, we had an interview with Mr. Edwards, and received most cordial assurances, that he would with great pleasure exchange with us any thing which related to insects, injurious to vegetation, that might be desirable. We communicated to Dr. Asa Fitch, of Salem, Washington county, the proposal made, and he very kindly consented to prepare a case of insects, injurious to vegetation, in this country, and forward it to Mr. Edwards, for the Museum of Natural History. This we communicated to Mr. Edwards, through Mons. Vattemare, and we are greatly gratified at receiving this case of insects.

LETTERS FROM M. VATTEMARE AND MILNE-EDWARDS, ESQ.

(Extract of a letter from A. Vattemare to Prof. T. Romeyn Beck, dated Paris, Feb. 9, 1854.)

"A collection of insects from Algiers, hurtful to vegetation, &c., presented by Prof. Milne Edwards, in the name of the professors and regents of the Museum of Natural History of Paris. This collection, destined to the Cabinet of Natural History, is to be submitted to the Agricultural Society, and to the particular attention of Asa Fitch, Esq., whose important labors, concerning

insects hurtful to vegetation, are most highly appreciated in Europe. The professors of the Museum of Natural History here, would be very thankful for a collection of the same nature from North America and particularly from New-York—specimens of the Hessian Fly, &c. The following is a translation of Prof. Milne Edwards' letter, transmitting this collection:

"'Sir—In accordance with your request to the administrator of the Museum, I have the honor to transmit to you a collection of insects, from Algiers, comprising 136 species, the description of which was published by Mr. Lucas, in his great work on Algiers, executed by order of the Government. I think this collection would be usefully placed in the hands of Mr. Asa Fitch. I therefore beg of you to submit it to the State Agricultural Society, (N. Y.), of which this able Entomologist is a member. I would likewise beg of you to obtain from your American correspondents, for the Gallery of the Museum, some specimens of the Hessian Fly, and other insects hurtful to Agriculture, in the United States.

"'I trust, sir, that you will consider this collection as another token of the interest felt by us, for your mission, relative to International Exchanges, and of the gratitude of the Administration of the Museum, for the services you have rendered to this establishment.

"'I have the honor to be,

MILNE EDWARDS,

Senior of the Faculty of Sciences, Administrator and Curator of the Collection of Entomology.'"

1. Cicindela maura Fabricius.
2. " moroccana Fab.
3. " littoralis Fab.
4. " barbara Lep.
5. " sardea Dejean.
6. " flexuosa Fab.
7. " littorea Fischer, *Goudoti* Dej.
8. " trisignata Illiger.
9. Drypta emarginata Fab.
10. Brachinus psophia Fab.
11. " scolpeta Fab.
12. Graphipterus luctuosus Dej.
13. " exclamationis Fab.
14. Siagona rufipes Fab.
15. " europæa Dej.
16. Scarites lævigatus Fab.

16. bis, Scarites arenarius Bonelli.
17. Ditomus capito Ill.
18. " clypeatus Rossi.
19. " sphærocephalus Olivier.
20. " barbarus Latreille.
21. " cornutus Dej.
22. Carabus morbillosus Fab.
23. " Varvasii Solier.
24. Scarites Pyracmon Bon.
25. Nebria complanata Linnæus.
26. " andalousiaca Rambur.
27. " rubicunda Schœnherr.
28. Apatomus rufus Rossi.
29. Licinus brevicollis Dej.
30. Calathus circumcinctus Germar.
31. Anchomenus pallipes Fab.
32. Agonum marginatum Lin.
33. " lugens Ziegler.
34. Pœcilus quadricollis Dej.
" bis, " numidicus Lucas.
35. Feronia hispanica Dej.
" bis, " Abax barbaricus Lin.
36. Broscus cephalotes Lin.
37. Acinopus giganteus Dej.
38. " picipes Ol. *megacephalus* Dej.
39. " sabulosus Ol. *obesus* Schœn.
40. Ophonus obscurus Fab.
41. " meridionalis.
42. Amara bifrons Ill.
43. Harpalus punctatastriatus Dej.
44. Onthophagus taurus Lin.
45. " punctulatus Ill.
46. Onthophagus Maki Ill.
47. Ateuchus sacer Lin.
48. " variolosus Fab.
49. Gymnopleurus pilularius Fab.
50. " flagellatus Fab.
51. Copris hispanicus Poiret.
52. Geotrupes daucei Gory.
53. Thorectes hemisphæricus Ol
54. " rotundatus Luc.
55. Oryctes grypus Ill.
56. Phyllognathus Silenus Fab.
57. Anomala Julii (*vitis* Fab)
58. Anisoplia floricola Fab.
59. Bubas bison Fab.
60. Onitis strigatus Erichson.
61. " furcifer Rossi.
" bis, Oniticellus flavipes Fab.
62. Trox perlatus Scriba.
63. Rhizotrogus dispar Buquet.
64. Hoplia bilineata Fab.
" bis, Amphicoma bombilius Fab.
65. " melis Fab.
66. Glaphyrus cardui Fab.
67. Cetonia squamosa Gory, Mulsant.
68. " morio Fab.
69. " squalida Lin.
70. Dorcus musimon Gene.
71. Pimelia scabrosa Erich.
72. " barbara Sol.
" bis, " Boyeri Sol.
" ter, " Duponti Sol.
73. Adesmia microcephala Sol.
74. Akis algeriana Sol.

75. Akis italica Sol.
76. Jalodis fidelissima Hoffm.
77. Aurigena tarsata Fab.
78. Cæcalus Buqueti Gory.
79. Sphenoptera rauca Fab.
80. Acmæodera acuminipennis Luc.
81. Agrilus amethystinus Ol.
82. Anthaxia inculta Germ.
83. Scaurus dubius Sol.
84. " atratus Fab.
85. Tentyria inæqualis Dej. *excavata* Sol.
86. " bipunctata Sol.
87. Asida lævigata Fab. male.
88. " " female.
89. " silphoides Ol. male.
90. " " female.
91. Isocerus ferrugineus Lat., Fab.
92. Blaps magica Erich.
93. " caudata Sol.
94. " gigas Fab. *Gages* Ol.
95. Opatrum granulatum Luc.
96. " emarginatum Luc.
97. Cleonus oculatus Fab.
98. " excoriatus Ill.
99. Phytonomus circumvagus Chevrolat.
100. Sitones griseus Fab.
101. Purpuricenus Desfontainæi Fab.
102. Stromatium strepens Fab.
103. Hesperophanes sericeus Ol.
104. Cartallum ruficolle Fab.
105. Clytus Boblayi Brulle.
106. Stenopterus mauritanicus Luc.
107. Stenopterus præustus, var. Fab.
108. Niphona picticornis Muls.
109. Agapanthia, irrorata Fab.
110. " annularis Ol.
111. " cynaræ Germ.
112. " suturalis Fab.
113. Phytæcia virescens Panzer.
114. Odynerus stigmaticus Fab.
115. Anthophora atro-alba St. Fargeau.
116. " pennata St. Farg. male.
117. Colpa aurea Fab. St. Farg.
118. Campsomeris collaris Fab. St. Farg.
119. Anthocharis Doucei Poir.
120. Chlænius spoliatus.
121. " vestitus.
122. " auricollis.
123. " aratus Guerin.
124. " varvasii.
125. " agrorum.
126. " chrysocephalus.
127. Stenelophus vaporariorum Fab.
128. Thais hypsipyle Fab.
129. Pieris rapæ Lin.
130. Anthocharis cursoria Ochsenheimer.
131. Colias edusa Lin.
132. Lycæna alexis Lin.
133. Polyommatus Phlæas Lin.
134. Thecla rubi Lin.
135. Polyommatus ballus Fab.
136. Arge ines Dupouchel.

Remarks upon the Insects named in the above list.

Whatever may be the future political destiny of Algiers, it may truly be said that *in science* France has there achieved *conquests which will endure*, and will contribute to the glory of her name in all coming time. Whilst the subjugation of that province was in progress, the specimens of natural history gathered and sent home by some of the officers of her armies, served to indicate the rich field for research which there existed; and immediately upon its becoming annexed to the French empire, a number of her men of science were commissioned and sent hither to make a full examination of its natural productions, and thus ascertain its resources. The results of this survey are embodied in the great work of M. Lucas, published by order of the government; and of the specimens collected, a portion of the insects have, through Prof. Milne-Edwards, been presented to the museum of our State Agricultural Society. These are enumerated in the above catalogue, and I am requested to furnish such a notice of them as will give visitors to the museum, and others, some acquaintance with their character and habits. As no copy of the work of M. Lucas, in which the history of these insects is given, is accessible to us, we are only able to speak of their habits generally, from our acquaintance with other insects to which these are related. A reference to that work, moreover, would show whether, as we suspect, a mistake may not inadvertently have been made, in some instances, in the above list. Thus, No 57, the *Anomala Julii* of Fabricius has all along been regarded as a different species from his *Vitis*, though they have been entered as being synonymous. Specimens of *Vitis* in my cabinet, from the island of Corfu, would appear to be quite distinct from this Algiers insect; still, the vine-chafer of our own country (*Anomala atrata* Fab., *cœlebs* Germ., etc.) illustrates how very widely in this group individuals of the same species may vary from each other. Of No. 118 also, we observe that the *Campsomeris collaris* is described as a new species from the island of Java, by St. Fargeau (*Hymenopteres*, vol. iii, p. 498), nor does the insect before us correspond with the description of *Scolia collaris* given by Fabricius (Ent. Syst. vol. ii, p. 233). Of course all such doubts as these will instantly be resolved by a reference to the work of M. Lucas.

The eight first species named in the above list pertain to the family of Tiger Beetles (Cicindelidæ), and are quite similar in their size, colors and marks to our American species, considerably numerous, belonging to the same genus.

The thirty-eight succeeding species (No. 9 to 43) and the eight near the close of the list (No. 120—127), belong to the family Carabidæ, one of the most extensive groups in this department of nature's works. Of these, we look with the most interest upon the two species of *Graphipterus*, this being a genus of insects peculiar to the African continent; and the white spots and stripes with which they are ornamented, are marks so unusual among the larger *Carabidæ*, that at first glance one would not suspect them to pertain to this family. With the still larger species of the allied genus Anthia (for specimens of which, my cabinet is indebted to Rev. David Irvine, late a missionary of the Presbyterian Board, in India), these insects show, in the marks alluded to, a relationship to the preceding family, and the gradual transition by which nature passes from one group to another of her works. Several of these *Carabidæ* are very like our American insects of the same genera; but it is rather remarkable that of the genus *Ditomus*, of which about two dozen species occur in the several countries bordering upon the Mediterranean and Black seas, we have no representative in corresponding latitudes upon this side of the Atlantic.

All the insects of these two families are carnivorous, attacking and devouring other insects. But though this is their general habit, it is now well settled that some of the species are injurious to fields of wheat, feeding upon the young plants and upon the grain in the ear. No. 36 of the above list, *Broscus cephalotes*, is one of these species. Though these two families have probably been more studied than any other insects, it is to be regretted that so little attention has been bestowed upon the habits of the several species in their larva and perfect states.

The twenty-eight next species (No. 44—69) pertain to the old Linnæan genus *Scarabæus*, which forms several families in systematic works at the present day. Of these insects, a portion feed

upon leaves, others upon flowers, and others upon dung. Those pertaining to the genus *Amphicoma*, of which we here have two species, frequent flowers, it is supposed for the purpose of extracting their honey, whilst the hairiness of their bodies serves greatly to aid in conveying the pollen to the stigma, and thus rendering the flowers fertile. To the same family with *Hoplia*, *Anisoplia*, &c., pertains the cockchafer of Europe, the most common and destructive of all insects belonging to the order of the Beetles, and the compeer of which, we have in our American May-beetle. Experiments go to show that whilst the most powerful poisons have no effect upon these insects, they are readily destroyed by alkaline preparations, which at the same time promote the growth of the plants to which they are applied.

No. 70 belongs to the family of Stag Beetles (Lucanidæ), the larvæ of which mostly reside in rotten wood.

No. 71—75, and also 83—86, pertain to the family Pimeliidæ, of which we have very few species upon this continent, whilst they are numerous upon the borders of the Mediterranean and in the deserts of Africa. Little is known of their habits.

The seven next species (No. 76—82) belong to the Buprestidæ, one of the families of the Snapping Beetle, which is noted for the brilliancy of its colors. The larvæ of these insects live in the solid wood of trees, doing much injury to timber by the holes which they perforate in it. The mature insects are frequently found in lumber yards and in newly built houses, having made their escape from the wood in which their larvæ had resided. They are sometimes many years in attaining maturity and making their escape from their burrows. A white pine plank in the steps at one of the doors of my residence shows a hole perforated from within by a larva in the year 1838, these steps having been built twelve years before. In the tenth volume of the Linnæan Transactions, Mr. Marsham records the exit of a *Buprestis splendens* from the wood of a desk which had stood in one of the offices in the Guildhall, London, upwards of twenty years. A still more remarkable case has been reported in this country: an apple tree, transplanted from the farm of Gen. Putnam, by his son, to Wil-

liamstown, Mass., was cut down when sixty-five years old, and a portion of it was manufactured into a table, from one of the leaves of which table "a strong and beautiful bug" ate its way out twenty years afterwards, a second made its appearance subsequently, and finally, at the end of twenty-eight years, a third made its appearance.

The six succeeding species, (87—94,) pertain to the family Blapsidæ, numerous genera and species of which inhabit the African deserts, whilst in this country there are very few. Their habits have been but slightly investigated. One of the most common species in Egypt, Forskahl relates, is cooked in butter and ate by the women of that country, from the idea that it will make them become fat. Of the *Blaps mortisaga*, or Churchyard beetle, Dr. Pickells reports, (Trans. of Assoc. Physicians of Ireland, 1824—1828,) that at different times, as many as two thousand larvæ were discharged from the stomach of a woman, who was addicted to the superstitious practice of drinking daily a quantity of water, mixed with clay taken from the graves of two Catholic priests.

The species of *Opatrum*, (No. 95, 96,) reside in sandy situations, whilst most of the Tenebrionidæ, the family to which they pertain, dwell in fungi and rotten wood, and others in flour, bran, meal &c. These last are the well known Meal-worms, (larvæ of *tenebrio*, *molitor*, *obscurus*, *curvipes*, etc.) of our granaries, flouring-mills and bake-houses. They are equally common in this country as in Europe: Nor are their ravages limited to the farinaceous grains. A small quantity of timothy and clover seed which remained in a pail after sowing, I found a twelvemonth afterwards, pervaded with and destroyed by larvæ and insects of *T. molitor*.

The four next species, (No. 97—100,) belong to the weevil family (Curculionidæ) so well known from the great mischief some of them do in stored wheat, rice, and other valuable seeds. Other species subsist upon the leaves, flowers and stems of vegetables. These are beetles, commonly of minute size, and with long slender snouts, which the insect employs to form a hole in which to de-

posit its eggs. It is very unfortunate, and tends greatly to mislead and confuse those who are not conversant with this branch of science, that in this country, the name weevil, which belongs to these long-snouted beetles only, is currently applied to insects so widely different from them as are the wheat midge or wheat fly and the Angoumois moth. Two of these Algiers weevils, it will be seen, pertain to the genus *cleonus*, one of the species of which (*C. Linariæ*) forms gall-like excrescences upon the roots of the *Linaria vulgaris*, the snap-dragon or "butter and eggs," as it is most commonly designated in this section of the country. This plant was introduced into flower-gardens in this vicinity about twenty-five years ago, and has now become by far the most formidable weed with which we have to contend—taking entire possession of acres of our best fields and setting at defiance all except the most persevering and laborious attempts to exterminate it. We have often thought that if some of the insects of Europe which prey upon this plant, could be here introduced, it might prove by far the most economical and effectual mode of reducing this "officious foreigner" to its appropriate limits.

The thirteen succeeding species, (No. 101–113,) pertain to the family of long horned beetles, (CERAMBYSIDÆ,) insects generally of a slender, elegant form and beautifully ornamented in their colors. The larvæ of most of them, however, are pernicious to timber and fruit-trees, boring holes in the solid wood. Examples of this family of insects are tolerably well known in this country being the borers in our apple, locust, maple and other trees.

The wasps and bees (No. 114–118,) are insects whose habits are so well known as to call for no remarks in this hasty review.

The remaining species (No. 119, 128–136,) pertain to different families of the group of butterflies, each species of which, in its larvæ state, feeds upon the leaves of some one or more plants. Of these, the *Colias edusa* will be noticed as very like the common yellow butterfly of our meadows and which gathers in such numbers upon the muddy margins of pools of water. Its larvæ in common with those of the other species of this genus, subsists

upon clover and other leguminous plants. And as this same species inhabits a district adjacent to us, it is a little remarkable that we never meet with it in Eastern New-York. Here all our specimens are of a pale yellow color, the tint of sulphur or of the canary bird, and pertain to the species named *Philodice* by Godart, which upon our side of the Atlantic occupies the place of the similarly colored *Hyale*, which is spread over the Old World, even to its easternmost confines, specimens of it having been sent me from Ningpo, China, by my friend Rev. M. S. Culbertson. Common with the *Philodice*, are individuals having the black border of both pairs of wings cut nearly or quite across by slender yellow lines which are the apices of the veins. These appear to be the *Colias Chrysothome*, var. A. of Boisduval, (*Lepidopteres*, vol. i, p. 643,) which he intimates may be a distinct species, but which we are more inclined to regard as a variety of *Philodice*. Occasionally also, specimens are found with us, having the whole upper surface of the wings dusted over with black grains though less abundantly on the disk of the upper pair, and with the black border wider and somewhat gradually shaded into the yellow color of the disk. These appear to coincide with Boisduval's description of *C. phicomone*, a species credited to the alpine districts of Europe and Siberia. Other specimens, very similar to these, are a trifle smaller and have the knob of the antennæ of a paler yellow, and brown on its upper side instead of black, and the yellow spots in the black border of the wings elliptic or oval instead of round. These I regard as the *C. nastes* of Boisduval, who received his specimens from Lapland and Labrador. In my collection is another New-York specimen much smaller than either of the foregoing, the wings expanding only one inch and a quarter. It is colored like *Philodice*, but the black border of the wings is much narrower, there is but a single silvery dot beneath in the centre of the lower pair, and the knob of the antennæ is pale fulvous, somewhat mottled with brown on its upper side. This I have ticketed *Colias santes* in my collection. We thus have in addition to the *Edusa*, what some will regard as five species of the genus *colias*, inhabiting the state of New-York. But these are all so very similar, and the several marks by which they are distinguished vary and gradually pass into each other to such an extent that it

is very doubtful whether they can with propriety be regarded as anything more than varieties of two species, the *Philodice* and *Phicomone* of Godart, the latter having a row of yellow spots in the black border of the upper wings in both sexes, whilst the former has these spots in the females only.

ASA FITCH.

Salem, N. Y. August, 1854.

COUNTY ASSOCIATIONS.

The returns which are herewith presented from the county associations show a most gratifying advance in the agriculture of the State. More systematic efforts are being made in every branch of farm husbandry, and the farmers are devoting their energies to the advancement of this great interest in a manner most creditable to them. The reports from several of the counties contain many valuable experiments, all showing that a spirit of inquiry is abroad, and that farmers are not unwilling to adopt suggestions which experience and science have proved most advantageous to their best interests.

The increased attention paid to drainage is producing most gratifying results. Better crops are produced, less liability to damage from insects and from the winter; and in almost every instance the returns show that the outlay is greatly overbalanced by easier tillage and more abundant crops.

The improvement in dairy products is most marked, as well as a very considerable increase in the yearly products per cow, both of butter and cheese. The inquiry as to the breed of cattle best adapted to the dairy is receiving attention; and the general opinion is, that our best native cows, which are superior as milkers, with a cross from a Short Horn, Ayrshire or Devon bull, produce the best cows for the dairy. While the milking qualities are generally retained, their aptitude to fatten more readily, when no longer useful for the dairy, is a decided advantage, and will, eventually, it is believed, be generally adopted in our best dairies. Care should be had in selecting the male animal, as one descended

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Trans. N.Y. State Agr. Soc.
1858

WHEAT MIDGE, HESSIAN FLY, &c.

We issued the annexed circular to upwards of one hundred gentlemen, engaged in farming, in May, 1858, in order, if practicable, to obtain some reliable information in relation to the history and ravages of these insects in our wheat crops. We regret to say that the annexed eight letters are all we have received in answer to this circular. We the more regret this from the facts which are given in the letters received; as we feel assured, if a general response had been given, we should have had materials from which some valuable results would have been secured. We have some facts which are of value in these communications; and we are greatly indebted to the gentlemen who have answered our inquiries. We intend to re-issue the circular, hoping to secure a much more extended reply, and thus be enabled to ascertain more fully the appearance and ravages of the insect, as well as the means by which their ravages may be ameliorated, if not entirely prevented.

The *Hon. Gamaliel H. Barstow*, of Tioga county, states that the wheat midge appeared in that section of the state about 1848; and that they came from the east, having been seen in Columbia Co., in 1838; that its ravages have been continued, more or less in Tioga, since 1848; but much less for the past two years, and hopes are entertained that it may be passing away. The best remedy that has been found, is to have the lands well cultivated, good seed sown, so as to secure *a healthy crop*; all other things being equal, the damage is much less.

John Johnston, of Seneca county, says the midge appeared in that county in 1848—same year as in Tioga—coming from the east. It has continued its ravages more or less since. The best means of mitigating its ravages, have been thorough drainage and better farming—giving earlier crops. Crops on dry lands and uplands less liable to injury than low, sheltered lands. Mr. Johnston has usually grown good crops of wheat; since the midge appeared, his crops have not been under twenty-five bush. per acre,

except in 1857, when he had a little over twelve bushels per acre; that owing mainly, however, to the great drouth of the previous autumn, and the cold and late spring of 1857.

Hon. *Joshua B. Smith*, of Suffolk county, says that the wheat midge is unknown in his neighborhood. The Hessian fly has done some injury.

Hon. *Samuel L. Fuller*, of Livingston county, says a circular was issued by the agricultural society of his county, but few answers were received. The ravages of the fly have been very destructive; dry lands escaped if any; Mediterranean wheat has suffered the least.

Hon. *James S. Wadsworth*, of Livingston, writes that the midge appeared in Monroe and Livingston counties in 1854, to a limited extent; came from the east. In 1856, one-half to two-thirds of the crops of wheat on *upland* were destroyed, and *nearly all* on the flats. Worse in 1857; over two-thirds of the crop; and in 1858, very little to harvest of white wheat.

Mediterranean wheat escaped generally, (from its being earlier as it is supposed,) perhaps one-fifth destroyed. There is no evidence that the midge was seen in the Genesee Valley before 1852, when it was seen in small numbers, in Monroe. The ravages of the midge has reduced the value of all the wheat lands in Western N. Y., at least forty per cent. Lands which sold readily at seventy dollars per acre, are now bought for forty dollars per acre. Mr. Wadsworth states that a respectable farmer, Mr. Coverdale, in Livingston county, lived, in 1828, on the St. Lawrence, forty miles above Quebec; saw the midge there that year, and had previously seen it in England, so that it is probable the midge was introduced there from England.

Hon. *Stephen Haight*, of Dutchess county, writes that the midge appeared in that county about 1828, and steadily increased from year to year, being more and more destructive, for twelve to fifteen years, when the growing of wheat was mainly given up. In past two years, both spring and winter wheat have been grown to some extent. Crops good, and no trouble with the midge. Uplands were invariably less injured by the insects than low lands. Mr. Haight is of the opinion that since abandoning wheat, and turning attention to other crops and grass, the farmers have secured a better profit from their farms than they ever did by growing wheat.

Joseph Watson, of Wayne county, writes that the midge appeared in 1850 and 1851, and increased up to 1858. It has not on-

tirely disappeared. Mr. Watson further says, that in Schoharie county, in 1835 and 1836, an injury by a worm, in the heads of wheat, similar to the larva of the wheat midge, appeared in the wheat. Dry uplands are very perceptibly less affected than low lands. Since 1852, the wheat crop is one-quarter short of a full crop; that is, less than one-quarter as much wheat has been produced, caused indirectly by the appearance of the midge. Early sowing on dry lands, and early varieties most successful, but no effectual remedy.

Hon. *G. Denniston*, Steuben county, writes that about 1854, some indications of the presence of the midge were discovered. The crop of 1858 was mostly destroyed. Estimates the damages by the wheat midge, at seventy-five per cent of the whole crop. No remedy has been found against its ravages. No satisfactory answer is given as to where the insect came from; but the fact stated by Mr. Coverdale, of the insects being seen near Quebec, would render it probable that in that section of the country, it may have been introduced from England. Mr. Haight states that about 1828, the same year mentioned by Mr. Coverdale, the insect made its appearance in Dutchess county. In England, the midge prevails to some extent. A parasite insect is known there, that mitigates its ravages. No evidence has been procured here that any parasite has been seen in this State. In England, it is believed that the thorough culture and preparation of their lands, and the use of good seed, have tended, as yet, to prevent the ravages of the wheat midge to any very considerable extent.

The insect has not left any section of which we have an account in these answers, since its first appearance, except as stated by Mr. Haight, in Dutchess. The entire abandonment, however, of the crops there, may have been the reason; and if the raising of wheat which has been lately commenced there, should progress, we may find that the enemy is still in that region, ready for its destructive work.

We think that there is sufficient evidence, given to show that *good farming*, thorough drainage when needed, will at least very materially mitigate the ravages of insects. The experience of Mr. Barstow, and Mr. John Johnston, show that this has been the case in their experience, and it certainly will prove advantageous to our farmers, to make their efforts in this direction, if they intend to continue the wheat culture. Good farming will probably enable them to raise at least moderate crops, and without this, it is

quite certain that the culture of wheat will, while the insect remains, prove a very unprofitable business.

We would earnestly urge upon gentlemen to whom our circulars shall be sent the coming season, to give us all the information in their power; and should there be a response from every county, we shall probably be able to compile a table, showing the appearance of the insect, the progress made, the time of its disappearance, and the extent of its ravages. Surely this would prove of great value to us hereafter, and facts may be collected which will enable us to adopt some system by which we may again be enabled to raise wheat to advantage. J.

CIRCULAR.

NEW YORK STATE AGRICULTURAL ROOMS,
ALBANY, *May*, 1858.

RAVAGES OF THE "WHEAT MIDGE," "HESSIAN FLY," AND OTHER DEPREDATORS ON WHEAT.

Wheat Midge.

The ravages of the wheat midge in this country, so severe and continued year after year, forms one of the most important incidents in the history of wheat culture, which has ever occurred. And the State of New York is prominent as the scene of the depredations of the insect. The statistics returned to the State Agricultural society in the year 1854, showed that the farmers of this State had that year experienced a loss of *several* millions of dollars from this pest; and in 1857 one of our citizens was injured to the amount of several thousand dollars by it; and in some sections of our State the wheat crop was almost entirely destroyed. These facts will serve to indicate to what an extent the wealth and prosperity of our State are at present affected from this cause. And the Executive Committee of the State Agricultural Society feel it to be a duty which they owe to their constituents and posterity, now, when the whole history of this insect and its ravages are fresh in recollection, to gather up full information upon these topics, and embody the same in a report, which will give a clear view of the remarkable career of this insect, its habits and economy, and will form an authentic record of these important facts for reference in all coming time. They therefore issue this circular, with the earnest hope of hereby obtaining the requisite information from each particular district, in all the wheat growing sections of the State, not doubting but that the persons to whom this circular is directed, will be able, from their own knowledge,

or by conferring with a few of their neighbors, to give in answer to it every fact of value relating to this subject which has occurred in their vicinity. Replies more particularly to the following queries are desired:

1. In what year was the wheat midge (weevil as frequently called) first noticed in your neighborhood? From what direction did it appear to come to you? Was it very destructive for a few years after its first arrival? Was the growing of wheat abandoned, and for how long a time?

2. What has been its history since? In what years has it been most destructive, and when has it been least injurious?

3. Has it wholly disappeared at any time; so that on examining the wheat heads in many different fields not one of the yellow maggots could be found?

4. Before the midge came in your vicinity, is any instance remembered thirty years ago or more, in which a field of wheat was badly injured in the same manner it now is by this insect—with the heads rough and ragged, and the kernels shriveled? If so, state the year and the particulars, so far as remembered.

5. What other grains have been infested by this insect?

6. Have any varieties of wheat escaped injury?

7. Are crops upon dry, hilly uplands less injured than those upon lowland intervales?

8. What has been the amount of damage in your vicinity the past year, and the probable yearly damage since the midge came into your neighborhood?

9. What remedies have been tried and with what success? Has any remedy proved effectual.

10. Has any parasite insect been seen which destroys the midge? If so, describe it.

11. Has any damage to wheat been made by the "Hessian fly" or other insect than the wheat midge? If so, describe the same.

Finally, state any other facts of interest within your knowledge relating to this insect.

It is recommended that specimens of the wheat midge or any other insect supposed to be injurious, which may be observed, or any parasite insect which is supposed to destroy the wheat midge, be sent to the Agricultural Rooms. They can be sent in a quill, enclosed in a letter, and an examination will be made by Dr. Fitch, Entomologist of the society, of all that may be received. The replies which may be received will be delivered to Dr. Fitch, and a carefully prepared statement will be published, embodying all

that may be ascertained in relation to the insects, which may be described, and copies will be sent to all persons answering these inquiries. Returns are requested to the Secretary, Agricultural Rooms, Albany, as soon as the questions proposed can be satisfactorily answered. B. P. JOHNSON, *Secretary.*

HON. G. BARSTOW—Nichols, Tioga Co.

March 9th, 1858.

B. P. Johnson, Esq.

My Dear Sir—In the journal of the State Agricultural Society for December, I noticed a circular of the Executive Committee of the Society, making some inquiries in relation to the history of the *wheat midge* (or weevil), as it is sometimes called. I have been a small farmer in the valley of the Susquehanna, for about forty years, and have grown wheat in a small way during that time. Since my residence here, the Hessian fly has made us two visits, and the midge one.

I shall endeavor to answer all the questions of the Committee though perhaps not exactly in the order in which they stand. I should think it was about ten years since the midge first appeared in this part of the Susquehanna valley. I presume they came from the east, as I well recollect seeing them in Columbia county, in this State, in 1838.

Their progress westerly seems, therefore, to have been very slow; but I believe they have traveled west with more rapidity within the last few years. Like Young America—they seem now to be rapidly going in the direction of Kansas and California.

The *midge* was not so destructive at its first appearance as afterwards. Its ravages very soon discouraged our farmers, and less and less wheat was sown till about 1855. Very little was sown in 1855. The harvests of 1855 and 1856 were the smallest we have had here. We have not wholly discontinued sowing wheat here at any time. In my own small way, I have continued to sow wheat every year, and never had less than half a crop, except once. In 1855, very little was sown; but, of that little, most of it escaped the midge; more was sown in 1856, and the crop in a great measure escaped; particular pieces on low ground suffered some; the harvest of last year having generally escaped injury. We sowed last fall about as usual. I never saw or heard of the midge in this valley until about ten years ago. I have resided here since 1812.

It has appeared in rye and oats, but in those grains but little injury has been done. The rye crop ripens too early for them, the oat crop too late in the season. They seem to commit their depredations upon the grains immediately after the blossom falls off; and there seems to be but a few days in which they do the injury. I should think about the second and third weeks in July is their time of visitation. If wheat is ripe by the middle of July, in our climate, it is a little too forward for the insect, it being out of the milk before the insect appears. No variety of wheat has wholly escaped the midge; but from my experience and from information from others, it is well settled with us that the *Mediterranean wheat* is the best. It ripens a week earlier than any other I have tried; I have begun my harvest of that kind of wheat the 12th of July; other wheat sown in the same field, and alongside, I have often known to be a week later. On the low flats or bottom lands on this river, the midge has been the most destructive. On *the high grounds back* from the river they have done less injury. No remedies have proved successful against the ravages of the midge; lime has been sown in the morning, when the dew was on, when the midge first appears; but I believe the injury to the sower has been greater than to the midge. No parasite insect has been seen here, to my knowledge, which destroys the midge.

I believe it is pretty well ascertained that all the insects and blights, which attack the industry of man through his crops, after a time disappear. The *Hessian fly* has appeared at various times, since I have had some knowledge of farming. My recollection now extends back more than sixty years; within that time the visits of the Hessian fly have not been very frequent, perhaps once in fifteen or twenty years. By changing the time of seeding, and sowing very late, the Hessian fly soon disappears. The Hessian fly attacks the early sown wheat, and the midge the late sowed. Luckily, the two insects do not both appear at once; coming singly we must cheat the midge by *sowing early*, and the Hessian fly by *sowing late*.

For the last two years I have sowed the Mediterranean wheat, and sowed the first week in September, and have seen nothing of the midge in my fields. The last time the Hessian fly paid us a visit, I changed my seeding time to the last week in September, and first week in October, and I saw no more of the fly.

Should the Hessian fly and midge combine their forces and attack the farmer at the same time, I suppose we should own beat,

and stop raising wheat till we starved them out. From the small amount of damage done here by the midge, within the last two years, our farmers begin to take courage that the midge is about to leave us.

In relation to the midge, as well as the Hessian fly, I have found *that crops of wheat of a healthy growth, where the land is properly cultivated*, all other things being equal, *the damage from either of those insects much less* than where the crop is but half put in, and the wheat of a poor and sickly growth. Let the indolent *half farmer* mend his way, and prepare and cultivate his land so as to get a healthy growth of wheat, and sow it so as to get an early harvest. In that case he will be beforehand with his enemy; but on the other hand, if he neglects the proper cultivation of his land, and puts off the proper time of sowing his seed, he may expect what *he* calls *bad luck* in crops, when his bad luck is nothing but the necessary consequence of bad conduct.

Yours, respectfully,
G. H. BARSTOW.

JOHN JOHNSTON—Near Geneva.

May 26, 1858.

B. P. Johnson, Esq.,
Secretary New York State Agricultural Society:

Dear Sir—I have received your circular respecting the wheat midge. The first season we noticed it in this county (Seneca) was in 1848, but I have no doubt we had some for two or three years previous. It came from the east to us. It had destroyed the crops of wheat in the eastern counties of this State a number of years before we knew anything about it but what we read in the papers, and fifty miles east of here it had ruined their wheat crops before it injured us. In 1848 it was not very destructive here, but in the following year it ruined the greater part of the crop on many farms, and on some totally. In every late season since, it has been very destructive, but in early seasons when wheat was ripe (or nearly so) by 10th of July, the damages have been greatly lessened. My own farm being *underdrained*, I have been able to obtain fair crops of wheat since the *weevil* or rather *midge* made its appearance. My crop has not been under twenty-five bushels per acre, with the exception of last year which was only a little over twelve bushels per acre. The failure last year was owing to the great drouth of the previous autumn and the unprecedented cold and late spring of last year. My wheat never

covered the ground until sometime in June, and was not ready to cut until 29th of July, later than I ever knew it in thirty-seven years, the remarkable season of 1836 exeepted. I eommeneed on the 29th of July that year also, but had a good crop, whieh was the only full erop I ever had that was not fully ripe by 17th of July.

I sow *salt* liberally on my wheat whieh generally *hastens* the maturity about four days, and that may almost save the erop from the midge. I would state that my wheat erop during the time of midge has been from fifty to eighty aeres; this season only forty-four, but this autumn I will sow sixty aeres. Were my land *not underdrained* I eould not raise wheat any better than many in this eounty who have abandoned wheat as a erop. If wheat eould be got nearly ripe by the 10th of July the loss from midge, I think, would not be great, and nothing but *underdraining* and a *higher grade of farming* to *bring the wheat earlier forward*, is the only way I ean see for eontinuing the wheat eulture in this State. We have never been one year free of the midge sinee 1848. In 1855 I found only a little and that only around the fenees or on some spot not throughly drained.

A number of years ago, perhaps about thirty, the heads of wheat were injured, resembling the heads injured by midge, but it was not midge, but a small white worm whieh did eonsiderable damage. The foliowing year wo still had a few, but sinee I have never seen them.

Barley, I am told, is often injured by midge. I seldom grow that erop; when I have, I have not seen any midge in it.

The *Mediterranean wheat* is least hurt by midge, but no wheat eseapes it. Crops on *dry land and on hilly land are less liable* to be injured than in sheltered plaees. I have heard of many remedies, sueh as sowing lime as the wheat eomes in ear, going through the field with torches during the time of midge; but I have been only using preventives, and not eures. I have not known of any parasite inseet destroying the midge. A small bird pieks a great many of the larvæ out of the heads of the wheat and I am told they havo been killed and their erops found full of it.

There has been very little damage by Hessian fly. In 1831 it was very destruetive to me, and again in 1844, being the only times in thirty-seven erops. But we have in this neighborhood some loss this year by a elear white worm in the root. It has taken, almost totally, some of the best looking wheat I ever saw at the samo season of the year; it eommenced its depredations

perhaps six weeks ago and spread rapidly in some fields, while in others there may be a few yards or even only a few feet ruined, and in others again to a considerable extent. On one field of thirty-five acres in this neighborhood there is considerable of it ruined, and although it looked the best I ever saw last fall and early this spring, I am afraid there will little of it make a crop. It is a very small, active, white worm; when looked at through a glass it appears to have two feet at each end; it is exceedingly bad to find, especially now; I have a friend trying to find some of them to send you in this letter. He tried yesterday without success, and is trying again to-day. I am well aware the same worm damaged my crop in 1844 more than the Hessian fly. I noticed some worms of the same kind in 1844, and from the appearance of the wheat they have destroyed now, I know it was these that half ruined my crop in 1844. They have now quit their depredations for this season. The roots of the wheat have sent out new shoots but it will never come to much (some of it, much of it to nothing). A great deal of mine, in 1844 never headed out. I sowed very early in 1843 and I have no doubt that was the cause of failure by that worm then and also now. I never began sowing before the 20th of September from 1831, until within a few years past, 1843 excepted, hoping to get my wheat to ripen early, and I notice it is all the earliest sown wheat that is affected by the worm, or at least that most forward in the fall. In 1843 I sowed early so as to have done before going to the State Fair at Rochester, which was the cause of reducing my wheat crop about 1,000 bushels. I have no doubt it is very unsafe, this sowing in the end of August or first of September; at least I know it is so hereabouts.

I have only a few very small spots taken by worm in my wheat. It did not come up until the 20th day of September, or at least not much of it. On fourteen acres on which I sowed a barrel of salt to the acre, there is none, while eleven acres adjoining and in the same field, has several spots taken by the worm, and even up to the division furrow, between the salted and unsalted. The fourteen and eleven acres were both sown at the same time, and both early, but dry weather set in and it was long in vegetating, which I think saved the crop. I have very little doubt but many crops have been destroyed by the same worm and the blame laid to Hessian fly. They are exceedingly bad to find, and as there is almost every year some little Hessian fly, if we find a few we are apt to think they do the deed or do all the mischief. I am now

fully convinced it was so with me in 1844. I go back to 15th day of September, before commencing sowing. If one of the worms can be found I will enclose it in this letter and mention I have done so.

Yours truly,

JOHN JOHNSTON.

Hon. JOSHUA B. SMITH—Hauppauge, Suffolk Co., L. I.

June 17th, 1858.

B. P. Johnson, Esq.,

Dear Sir—Your circular of May directed to me, proposing several inquiries in relation to the destructive ravages of the wheat midge, has been duly received. In answer to inquiry, first in what year was the wheat midge first noticed in your neighborhood? From what direction did it appear to come to you? Was it very destructive for a few years after its first arrival? Was the growing of wheat abandoned, and for how long a time? Answer.—The wheat midge is unknown in my neighborhood, and so far as I have been able to ascertain, in my town and county. The answer to the first, renders one to the nine following needless. In answer to the eleventh inquiry, whether any damage to the wheat has been made by the Hessian fly. The wheat crop, until the past and present year, have generally escaped serious injury by the fly, for the past ten or twelve years. Last year it was again visible; and the present one the complaint is more general of its destructiveness; some crops will be injured by it. To what extent, I am now unable to say. I have sown the Mediterrancan for the last twelve years, and have never seen any signs of the fly until the last and present years.

Respcetfully yours,

JOSHUA B. SMITH.

SAMUEL L. FULLER—Conesus, Livingston Co., *Nov.* 12, 1858.

Hon. B. P. Johnson, *Secretary, &c.*:

Dear Sir—In October, a son of Mr. J. S. Wadsworth handed me your circular in relation to the "wheat midge," "Hessian fly," and other depredators on wheat.

The Livingston County Agricultural Society issued the enclosed circular, and circulated about one thousand among the farmers of this county. In reply, I have received six communications, eliciting no valuable information further than this: the early ripened, and quickly ripened wheat, escaped the best.

The summers of 1856 and 1857, I spent in Seneca county, and only know by report, that the wheat was injured over a large section of the county in 1856; I had heard it was in Ontario county the year before, but it was a rumor; still I always supposed it came from the east. The growing of white wheat has ceased to be the crop of the Genesee Valley. The Mediterranean wheat is said to be much improved for the last year or two, and many suppose it may be made a partial substitute; we shall probably raise enough for our bread of Mediterranean.

1857 and 1858, the white wheat was destroyed, with now and then an exception. It has not disappeared at any time.

I have never heard of the wheat being injured years ago by the midge. Some of my friends have complained of the midge in their barley; and I have heard rumors of clover seed being injured also; but this latter not sufficiently reliable for me to state it as a fact.

The Mediterranean has been injured the least.

The *dry land escapes* if any does.

The damage is the entire *profits* of the wheat crop at least, and the consequent depreciation in the value of lands of at least of $20 per acre, in the wheat growing towns of this county.

We *have tried good farming* with partial success.

Know of no parasite which destroys the midge.

In 1856 there was considerable damage by what was called Hessian fly in this neighborhood. The stalk was eaten into near the lower joint, and the straw would break off, many small worms being found in the stalk.

I have no knowledge in regard to the midge, other than most of farmers—that we find a fly about the size of a musquito in the fields, and soon the little red maggots in the head.

I have waited the answering of your circular, hoping "something might turn up." There are a few men in the county who will act in this matter of the midge; but the large majority seem inclined to consider it a visitation of Providence, and sit quietly down under it. Perhaps they are the wisest.

Very respectfully yours,

SAMUEL L. FULLER.

Hon. STEPHEN HAIGHT—Washington, Dutchess Co.

June 7th, 1858.

Friend B. P. Johnson:

I am in receipt of a circular which purports to be issued by the Executive Committee of the New York State Agricultural

Society, for the purpose of collecting information concerning the ravages of the wheat midge. I am happy to render any service which will assist in so important a matter.

To query 1. I answer to best information and recollection: Their first appearance was about thirty years ago in my county. They pretty steadily increased from year to year; their ravages more and more destructive for some twelve or fifteen years, when our farmers were obliged to abandon wheat growing entirely. Some few farmers, the two years past, have ventured to sow a little wheat, both winter and spring wheat, and I have had good crops; no trouble with the midge; we consider they were northern emigrants.

2. I am not prepared to answer to a certainty.

3. The two years last past, I have heard no complaint of any injury by them.

4. I have no recollection of anything of the kind, and presume I may safely say no.

5. No other grains have been injured by them.

6. No varieties escaped, although it was always understood that the bearded varieties were injured the least.

7. Wheat growing on uplands *were invariably injured less* than upon lowlands.

8. It would be a difficult matter to get at the damages sustained by the farmers of Dutchess, during the twelve or fifteen years that they were trying to raise wheat—and getting straw instead of wheat. It must be, however, a very large amount; but after abandoning the raising of wheat entirely, and giving their attention to other crops and grass, I am of the opinion their farms have yielded a better profit than they ever did by growing wheat.

9. I don't know of any remedy, unless by refusing to raise wheat to feed them. We have starved them out.

10. Don't know of anything of the kind.

11. During the time that wheat was generally sown, it frequently happened that it was much injured by the Hessian fly.

12. I hope we have got rid of them.

Yours, respectfully,

STEPHEN HAIGHT.

JAS. S. WADSWORTH, Esq.,—Geneseo, Livingston Co.

My Dear Sir—I hope your other correspondents have been more attentive than I have to your excellent wheat midge circular. I

will answer your questions as well as I can—premising that I am not a close observer in such matters, but I have made a good many inquiries in this matter. The midge was seen here in 1854; a little in Monroe and Livingston counties; did no material damage; more seen in 1855; did no material damage in this county; considerable in Monroe; came from the east. In 1856, the midge took from one-half to two-thirds of the crops in this county on upland, and nearly all on flats; at least 2000 acres on flats, which would have yielded thirty bushels per acre, not harvested. Worse in 1857, took over two-thirds of crops; 1858, very little white wheat to harvest; a few fields escaped; generally destroyed. Mediterranean wheat escaped generally (as it is supposed from being earlier); perhaps one-fifth Mediterranean destroyed; spring barley very much injured this year by midge. In some cases, one-half to two-thirds crops taken. Winter barley too early for midge. *Very little* white wheat now sown in western New York.

No evidence that the midge was seen here (Genesee valley) before 1852, when it was perhaps seen in small numbers in some localities in Monroe county. The midge has reduced the value of all the wheat lands in western New York, at least forty per cent. Lands which sold here readily for $70 per acre, can now be bought for $40 per acre.

No remedies tried. No parasite insect seen; very little Hessian fly of late years. The enclosed extract from the census returns of 1855 are supposed to be tolerably accurate; not too high; it is not supposed that this county and Monroe, will have a supply of wheat this year.

Mr. Coverdale, a respectable farmer in this county, lived in 1828, on the St. Lawrence, about forty miles above Quebec; saw midge there that year; had previously seen it in England. I do not think of any other information I can give you. I hope you will soon let us have what you have collected. Is this an English insect? What is done for it there? What of the parasite? Has it left any region in which it was ever fairly established.

Truly yours, JAMES S. WADSWORTH.

August 30th, 1858.

JOSEPH WATSON—Clyde, Wayne Co.

1. Midge appeared in 1850–51, from the east; growing wheat never entirely abandoned.

2. The insect increased annually until 1858; then least destructive; in *cold wet seasons* which were *late* the most.

3. It has not totally disappeared at any time.

4. Before the midge came do not recollect in this section of any injury to wheat similar to this, (but, in *Schoharie county*, my father says, in about 1835–6, a worm a quarter inch long, white, brown head, appeared in wheat heads and *roughed* them, or the birds did it in catching the worms, but they have not appeared since. Father died twenty years since in that county.)

5. Summer barley, red clover and mullen, have been infested by this insect; most in 1854.

6. No variety of wheat has escaped.

7. Dry *hilly uplands very perceptibly less affected* than lowlands.

8. As to damage, can't say very definite; this year not much, as no great breadth was sown; but it is safe to say that the wheat crop product here, since 1852, is less than one-fourth of a full crop annually, before or without the midge. I mean to say in my answer to this, that probably less than one-fourth of the wheat has been produced, that would have been, had there been no midge; but as to the damage itself, it would be hard to determine, as much of the land upon which wheat would have been sown, has been put to other more sure crops; besides, my experience is, that where I could get thirty bushels white wheat, I could get only twenty to twenty-two bushels of Mediterranean. *The loss or damage to our* county is *hard to over estimate*, caused by this *yellow mite*.

9. As to remedies, early sowing on dry lands and early varieties most successful, but no effectual remedy.

10. I have no knowledge of any parasites; report says there are such, but never have discovered any.

11. Too early sowing, to *escape the midge*, has the tendency to encourage the Hessian fly, and in some instances has done so. (First a white, changing to a flax seed form and color, near the root.) This destroyed my spring wheat, June, 1855.

Yours, JOSEPH WATSON.

December 20, 1858.

HON. G. DENNISTON—Prattsburgh, Steuben Co.

January, 21, 1859.

B. P. Johnson, Esq:

Dear Sir—I received your circular soliciting information respecting the ravages of the weevil or wheat midge, in Steuben Co. I have delayed my reply until all the facts in relation to the crop of 1858 could be collected. These, I can assure you,

have presented a gloomy picture to the farmer of our section of the State.

Some eight years ago we heard of the midge being seen and felt in some of the counties eastward. In Cayuga, then afterwards in Ontario, and then, the next year, in Yates; but, as yet, we knew nothing of the insect, except from report. It seemed to us like some *eastern plague* traveling westward, with which, in turn, we were doomed to be afflicted.

Our wheat crops grew luxuriant and productive, while our neighbors of Ontario and Yates, complained of their being "cut off." We had full garners of fine plump grain, while they reaped little else but straw and chaff.

About five years ago, some of our farmers began to discover appearances of the midge in their wheat. A corner of a field, or the outer edges, were somewhat injured, but nothing very material was developed for a year or two; but gradually the ravages seemed to increase, particularly in the crops more backward and late. It was then said "you must sow your wheat so that it will come to maturity early, in order to escape the (weevil), midge." Our farmers consequently sowed earlier than usual, but the *winged enemy*, by some means, managed to make their appearance just at the particular time they could commit the greatest injury; as if to put to nought all our wisdom and precaution, they totally destroyed all our earlier crops, and left the later unscathed.

Then, to avoid the insect, our farmers sowed late, so that the crop would come in after the period of its ravages. Some of our spring wheat, by this, has escaped; but I know of no particular rule that will guard us against its ravages, like all spoilers of the property and substance of others, they are ever on the alert for plunder.

The crop of 1858 was mostly destroyed by the (weevil) midge. The winter wheat did not average more than five bushels per acre throughout the county; whole fields were hardly worth harvesting. The spring wheat, sowed late, fared better and produced a fair yield. I should calculate that, on the average, the midge destroyed the crop of winter wheat in our county, to the value of *seventy-five per cent of the whole crop.*

I have heard of one or two fields, where the midge did not make their appearance, and the yield was consequently from twenty-five to thirty bushels per acre; these are now the exceptions to the general rule.

If the midge continue as last year, we must leave off sowing winter wheat, unless, perchance, we can hit upon some means to prevent their depredations. Our farmers are "*experimenting*;" but as yet without avail. About the time our wheat crops are in *the blow*, we can see myriads of pale yellow flies, with slim bodies, on gossamer wings, flying swiftly from head to head, depositing their "OVA," and as the crop matures we find the heads *erect* and empty, or rather *erect*, because they are devoid of value.

We are now in the midst of the plague; how long it will remain we have no means of ascertaining; but like all others, *we hope* for the period of its departure.

Very respectfully yours,

G. DENNISTON.

WHEAT AND CHESS.

In Mareh, 1857, Benj. Hodge, Esq., of Buffalo, "offered a premium of $100 to the person who shall demonstrate that wheat turns to ehess. The premium to be awarded under the supervision of the New York State Agrieultural Soeiety, under sueh rules and regulations as a eommittee appointed by the Soeiety shall preseribe."

We reeeived a letter, 20th July, from Samuel Davison, a respeetable farmer of Greeee, Monroe Co., saying "that on the 10th of Mareh last, he eommeneed an experiment on wheat, to produee ehess therefrom; and the experiment has sueeeeded; and requesting to have a eommittee appointed to examine the wheat growing, to test the truth that wheat turns to ehess." He also requested that the eommittee for next year be appointed to try the experiment under his direetion, &e.; and he elaims the premium offered, &e.

As here was a direet offer and an aeeeptanee, it was thought advisable to have a eommittee seleeted, and an examination and thorough trial had. J. J. Thomas, of Cayuga; Prof. C. Dewey and L. B. Langworthy, Esq., of Roehester, were seleeted as the eommittee.

The eommittee met at the offiee of the Rural New Yorker, in Roehester, on the 5th of August; and Mr. Davison was present with the wheat and ehess whieh he had grown. The eommittee, after obtaining all the information from Mr. Davison, as to the manner of preparing the ground and managing the same after the wheat was sown, proceeded to separate and examine the stalks presented; but after a eareful examination under the mieroseope, they were unable to find any ehess growing from the wheat; but as the grain and husks were so mueh deeayed, nothing satisfaetory eould be determined. A report will be presented of the whole examination, by the committee. The eommittee, as requested by Mr. Hodge, drew up regulations for a trial hereafter, which was satisfactory to Mr. Davison; and persons will be

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useful and well adapted to our country. We hope to make this interchange of value to the agricultural interest of our State and country, and are satisfied the farmers will furnish us with all the facilities necessary to continue the exchanges.

WHEAT MIDGE.

Everything relating to this destructive insect is interesting at this time, when such serious ravages upon our crops are chronicled from our State and the Canadas. We give an extract from a letter from Dr. Fitch, Entomologist of the Society, in reference to a parasitical insect in England, which is not known in this country. The Doctor refers to his essay, published in the Transactions of the Society for 1845, page 255. He says:

"In that essay you will see I pronounced our insect to be identical with the *cecidomyia tritica* of Europe. When that publication reached Europe, one of the most eminent French Entomologists of the present day, C. B. Amyot, at a meeting of the Entomological Society of France, called attention to what I had written, decidedly dissenting from the correctness of my statement; that the insects of the two continents were one and the same species. It was several years before I became aware of this—a letter which Mr. Amyot addressed to me having never come to hand. I immediately forwarded to Dr. Signovet specimens of the fly, to be handed to Mr. Amyot. He on receiving them called to his aid one of the best judges upon subjects of this kind in the city of Paris, and they gave these specimens a most scrupulous examination and comparison with European specimens. The result Mr. Amyot communicated in detail to the Entomological Society, at its next meeting, as I learn from their published proceedings. The specimens of the two continents were found to be identical in every minute particular which the microscope revealed, and Mr. Amyot gave his full assent to the correctness of my statement. As this insect continued to be so destructive to the wheat crop in this country, year after year, the question presented itself forcibly to my mind, why is it that this little creature is so vastly more injurious here than it is in Europe—why does it not multiply there and destroy wheat

crops the same that it does ours? and I was able to give but one solution to this query. From all the foreign accounts, it appears that whenever the midge becomes so numerous as to be perceptibly injurious, instead of continuing its ravage, it suddenly and totally disappears, and in place of it the fields next year swarm with the little parasitic bees which have destroyed it. But in this country no such parasitic destroyer appears to quell it, and I have hence supposed that we have received this insect from Europe, whilst its parasitic destroyer has not yet reached our shores. Thus we are hence without nature's appointed means for preventing the undue multiplication of this insect. We have received the evil without the remedy; and hence it is that this little creature revels and riots in this country without let or hindrance. As a result of this view, it followed that if we could import the parasitic destroyer of this insect from Europe, it would here multiply, and check the ravage of this pest, the same that it does abroad. This being a matter of such vast moment, involving a saving of many millions of dollars to this country, every year, as I was corresponding with Mr. Curtis, President of the London Entomological Society, I addressed him a letter upon this subject, a year ago last spring. This letter he laid before the Society, and it formed a prominent topic of discussion at one of their meetings, the members being astonished to learn the ravage which this insect was committing in this country, and they mutually agreed that if the midge presented itself to the notice of any one of them, so that they could obtain living specimens of its parasite to forward to me, they would do so. In its larva state these parisites might readily be sent to this country in a pot of moist earth; but as they can only be obtained in season when the midge is abroad in considerable numbers, it may be several years before we can get it."

[We were informed by J. H. Klippart, Secretary of the Board of Agriculture, Ohio, that a parasitic insect had been discovered there which preyed on the wheat midge. If this should turn out to be so, then we shall have an opportunity of testing the value of this parasite. As we have not seen the parasite, we shall look with interest to the investigations Mr. Klippart is making in relation to the wheat midge.]

1859

DR. FITCH'S SIXTH REPORT ON THE NOXIOUS AND OTHER INSECTS OF THE STATE OF NEW YORK.

The sixth report of Dr. Fitch, which was being prepared for this volume of the Transactions, has been delayed by his illness, which has prevented its completion in time for this volume. It will be given in the succeeding volume, together with the seventh report. The delay will enable him to prepare the report more fully than he would have been able to do, had his sickness not prevented its completion. His health is now restored, and he will prosecute his work with renewed energy in preparing the most important reports of the investigations thus far.

We are gratified at the great interest manifested in these investigations. The demands for the reports already published, come from every section of our own country, and from every foreign country with which we are in correspondence. The saving to many of our farmers and horticulturists, by observing the directions given in the reports published, have already amounted, we are confidently assured, to more, in a pecuniary point of view, than the entire expenditure made for the promotion of agriculture by our State government. We are confident that each succeeding year will add largely to this amount, as the number of intelligent farmers will be increased, who will adopt the suggestions made in relation to the culture and preservation of their trees, and the advice given in relation to the ravages of the devastating insects upon their crops and fruit and forest trees. We trust the Doctor's health and strength will be preserved so that he shall be enabled to complete his work, and leave to the farmers of our country a legacy more rich than that which any hero has ever given the world.

We are gratified in presenting two addresses of Dr. Fitch before the Society; one giving a summary view of "our most pernicious insects," the other "on the curculio and the black knot on plum trees."

These will be found of great value, and the latter, on the curculio, is one of the fullest and most reliable publications on this destructive insect and its ravages which has been published. The remedies which have proved the most efficacious are here given, and we cannot doubt, that a careful examination of these, and strict attention to the suggestions given will prove of incalculable advantage to our fruit growers. J.

From Trans. N.Y. Ag. Soc. for 1859.

ADDRESS, ON OUR MOST PERNICIOUS INSECTS,

DELIVERED AT THE ANNUAL MEETING, FEBRUARY, 1859.

By Asa Fitch, M. D., *Entomologist of the Society.*

[Note.—The Society has done me the compliment, each year, of requesting for insertion in its Transactions, a copy of the Lectures I have delivered at its annual meetings since I was honored with the appointment of its entomologist. But as everything of value in those Lectures has usually been embodied in a more full and definite form in my annual reports, I could not regard it as either necessary or judicious to thus encumber the Society's volumes with repetitions of the same observations. As the following Lecture, however, in addition to some general views of the subject, contains a succinct statement of the habits of several of our most pernicious insects, with reference to specimens which are permanently remaining open to public view in the Society's Museum, it perhaps possesses sufficient value to entitle it to the publicity here given it.]

Mr. President and Gentlemen—It was long ago remarked, and the saying has often been repeated, that "*America is the land of insects.*" It is not difficult to perceive what has given rise and currency to this sentiment. When this branch of science was in its infancy, Linnæus, the great legislator of Natural History, gave to one of the large, beautiful moths, common in the United States, a name, indicating it to be the head, the king, of the whole insect race. Eighty and a hundred years ago, the specimens of insects which were gathered in this country and taken to Europe, showed to the men of science there, so many singularly formed objects of this class, widely differing from anything which had been discovered in the old world, that it naturally impressed them with the idea that this quarter of the globe was peculiarly rich in curiosities of this kind. And about the same period, the sweeping havoc in our wheat crops, which was made by the Hessian fly, was a phenomenon unparalleled in the whole history of wheat culture from the early ages of the world down to that time. That a minute insect, nestling in the root and stalk of the growing wheat, should be so excessively numerous as to find every blade in the field, and totally destroy this crop over a wide extent of country, excited the astonishment and also the alarm of the whole civilized world. And from an occurrence so novel and so remarkable, it might well be inferred that there must be something in the climate, or some other physical peculiarity of this country, eminently favorable to insect life, to cause these creatures to become thus excessively multiplied.

And that America *is the land* of insects—that we are here sustaining greater losses from this class of objects than are experienced in corresponding parts of the old world—and that we shall be obliged to study their habits in order to successfully combat them and prevent their ravages, before our soil can possibly sustain so dense a population as exists *there*, scarcely admits of a doubt.

In the researches in which I am occupied, I have constant occasion to examine the statements which European writers give of *their* injurious insects, and the depredations which they commit, in order to compare them with our insects here. I thus come to know it as a fact, that the losses

which *we* sustain from these pests, *immeasurably* surpass everything of this kind to which they are subject in Europe. Insects which attract much public attention there, and are regarded as *serious evils*, would, in this country, be deemed scarcely worthy of notice, the damage they occasion is so trivial. There, if an insect appears in their wheat fields, by which the crop is shortened an eighth or a tenth from its average yield, whole communities become alarmed; whilst here, so slight a loss would be disregarded and would pass wholly unnoticed. The self same insects, which there appear *tame*, and only occasionally show themselves as depredators, now in one district and then in another—these same insects, on passing across the Atlantic, appear to become armed with the club of Hercules. On reaching our shores, they multiply;—they advance over our country like an invading army;—they utterly devastate the vegetation which they attack;—they continue their destructive work season after season;—and it is *not* till after a long series of years that they become perfectly naturalized in our midst, and sink back into their appropriate sphere, so as afterwards to remain within the bounds which Nature appears to have designed they should occupy. Such at least has been the history of the Hessian fly, before mentioned—the insect with which we have had the most extended and full experience. Originally introduced into the town of Flatbush on the west end of Long Island, doubtless in some of the straw which they had used for packing their goods, by the Hessian troops which disembarked there the latter part of August, 1776, it two and three years afterwards became so multiplied as to destroy the fields of wheat in that town. And from thence as a central point it gradually spread, extending itself in every direction, till it penetrated the farthest bounds of our territory where wheat was grown—marching over our country like a triumphant conqueror—for several years devestating the wheat crop wherever it arrived, and afterwards repeatedly returning and renewing its ravages after it was hoped it had disappeared. But now, for many years, we have heard little of the Hessian fly, and it would scarcely be known that we had such an insect in our country. A person engaged in collecting insects, however, will every year meet with a few of these flies, in sweeping with his net in almost any of our wheat fields. Why does it never multiply now, and cut off our crops as it did formerly? I doubt not it is because its insect enemies have now become so well acquainted with it and so skillful in combatting it, that if it begins to grow numerous in any district, they immediately multiply also, and thus overpower and suppress it.

And what has been the European history of this same insect? During the half century that it was committing such havoc upon this side of the Atlantic, no traces of any such insect were found in any part of Europe. And notwithstanding the manner in which it first appeared here, and gradually advanced over our country, plainly indicated that it had been introduced, yet the world with one consent adopted the opinion that it was a native insect of this country, and that it did not exist elsewhere. It was not till the year 1833 that we had any evidence that this insect was

to be found in Europe. That year, in two of the German principalities, the wheat crop was seriously injured by an insect so like the Hessian fly that M. Kollar, in his Treatise on Insects, published four years afterwards, pronounced it to be that insect, though others doubted his being correct therein. And the following year, 1834, Prof. Dana, of New Haven, who, in company with Mr. Herrick, had made the Hessian fly a subject of special investigation, on going into the wheat fields along the shores of the Mediterranean, at once detected this same insect there, both in Spain, Italy, and on the Island of Minorca. This discovery he communicated to Mr. Herrick, by whom an article on this subject was communicated to Silliman's Journal--this being the first dissent on record to the then universal belief which had so long prevailed, that this insect did not exist in Europe.

And finally, in 1851, along the banks of the Volga in Russia, the wheat crop was severely injured by an insect that we have quite conclusive evidence was the Hessian fly. This Volga insect is described by Col. Motschultsky, as a new species, like the Hessian fly of the United States in its habits and appearance, except that it is paler colored, and not black as Mr. Say represents the Hessian fly to be. Now when it first hatches from its pupa state, our insect is of a tawny yellow color, and I cannot but think that had the Russian entomologist kept his specimens alive, he would have found them within two or three days changed to black.

These few facts, the appearance of this fly in Germany in 1833, along the shores of the Mediterranean in 1834, and on the river Volga in 1851, comprise all of the European history of this insect—an insect so rare in its native haunts that it is scarcely known to exist there, but on being brought to our shores has caused a loss to us of uncounted millions of dollars.

The wheat midge also, it is probable, is doing more damage at present, in a single year, in the State of New York, than the total aggregate of the losses which it has occasioned in Europe. Mr. Curtis, in his papers on the insects affecting the grain crops of Great Britain, gives no intimation that a wheat field has ever been known to be so badly devastated by the midge or by any other insect, that it was not worth harvesting. But in this country we at the present time, have the midge throughout the northern and middle States; at the south they have the joint worm; at the west the chinch bug; three insects in the different sections of our country, each destroying the wheat crop to an extent which appears to be unparalleled by anything known of this class of creatures in our father-land.

Nor is it in our grain crops merely—in our orchards, in our gardens, *everywhere* in fact, we see similar evidences that "America is the land of insects." Look at the bark-louse of the apple tree, which, though common throughout the continent of Europe, has never shown itself as a serious evil there. But in this country, through a large district bordering on Lake Michigan, every apple tree has of late years been overrun and almost every tree has been killed by this very insect.

It is unnecessary to recite further facts, of which there are many bearing upon the same point. Enough has already been advanced to show that our country, although so favored of Heaven in most respects, is more in-

fested, and is sustaining greater losses from enemies of this kind, than any of the other sections of the world the climate and productions of which correspond with ours.

This being our situation, we readily perceive how important, how indispensably necessary it is, that the habits of this class of objects should be thoroughly investigated, and that full and correct information with respect to them should be obtained and should be disseminated among the cultivators of our soil. For, with the meager knowledge which they at present possess upon this subject, they are powerless, and these pests are allowed to commit their depredations unchecked and unopposed.

As so little knowledge of these creatures is diffused through our community, and so very few persons have ever seen the insects which are causing such vast losses in our land—the parents which breed the different kinds of worms and caterpillars which we see devastating our fields of grain and our fruit trees—I have thought I could not render this audience a more acceptable service, and occupy a portion of your time this evening more profitably, than by exhibiting to you specimens of some of our most destructive insects;—since a first and most important step towards a knowledge of any object, is, to have a clear and accurate idea of the looks, the appearance of that object; and it is impossible for the mind to gather from written descriptions or from drawings, so vivid and satisfactory an impression as is instantly obtained by a view of the thing itself.

Unfortunately however for an exhibition of this kind, several of the most important of our injurious insects are so exceedingly minute, that the eye, without the aid of glasses, is unable to discern anything more than their general appearance, their size and color. We are obliged to take them, however, just as nature has formed them. They will not expand themselves and become more distinctly visible, for our accommodation. And in order to see them at all, it is necessary that the specimens be taken in the hand, and so held that the strongest light which we have in the room, will fall directly upon them. Moreover, these minute objects, when dried and preserved, are so very fragile that a breath of air would break them into fragments—so that were they openly exposed, they would be destroyed before a dozen persons perhaps had looked at them. I have therefore endeavored to make the best arrangements for presenting them to your view, that their delicacy will admit of. They are placed in glazed boxes, which can be passed from hand to hand through the audience. And the several specimens in each of the boxes, are ticketed separately, and so plainly, that every one will readily understand what it is that he is looking at. All the specimens being thus distinctly explained by the labels attached to them, I think everything contained in each box will be intelligible and perfectly understood by every person into whose hands they come.

And I would further state, that, as such minute objects can always be seen so much better by daylight, than they can be by even the best artificial light, these same specimens will be on exhibition at the Agricultural Rooms, through the day, to-morrow—after which they will be placed in the Insect department of the Museum of the State Agricultural Society.

Preparatory to passing these specimens into the hands of the audience, I may briefly state the contents of each box. I have selected for exhibition and for a few remarks on this occasion, *nine* of the most pernicious and destructive insects which we have in our country. *Five* of these are depredators upon *the wheat crop*, and to some extent upon our other grain crops in districts where they do not find all the wheat they require for their accommodation. These five insects are,

The wheat midge, the grain weevil, the Hessian fly, the joint-worm, and the chinch-bug.

All these are very small insects. Yet, notwithstanding their diminutive size, and their seeming insignificance, some of them have done and are doing a greater amount of damage by far, than any of our other noxious insects. After looking at these pigmies, I presume it will be a relief to your eyes to be presented with something larger, and more cognizable to the senses; and I have therefore selected *four* of the most important depredators upon our fruit trees, namely,

The moth which produces the caterpillars upon our apple and cherry trees,

The apple tree borer, the peach tree borer, and the eurculio or plum weevil.

Many persons in the audience, I doubt not, will inspect these specimens more intelligently, and will recollect their appearance much better, if, as I hand them out, I state the contents of each box, and say a few words explaining the particular habits of each of these insects.

First, then, the Wheat midge.—This is the insect which, of all others, is doing us the most damage at the present time — causing a loss to the farmers of our State, amounting to millions of dollars annually. As already stated, the midge is spread everywhere through the wheat-growing districts of the Northern and Middle States, and also through Canada and Ohio. This insect is an exceedingly small, bright yellow fly, not a quarter the size of the common mosquito. And though there are countless myriads of these flies in every part of our State, very few persons have ever seen this fly, knowing it to be the midge.

It may add to the interest with which you will look upon one of the specimens in this box, to be informed, that I suppose you are there viewing, what only two persons in the world have ever seen, before this evening — the male of the wheat midge. We learn from Mr. Curtis, that this has never yet been found by any of the British entomologists, and only one person in Europe is known to have discovered it — Meigen, a German writer on insects, who has been dead many years. On coming to see what a mere atom this male fly is, you will be little surprised that collectors have so universally failed to detect it — for (if I may be allowed a Hibernicism) on looking at it, you will find it's so small you can't see it. The specimen is so placed as to project from the point of a triangular piece of paper, to which it is glued; and all that the sharpest eyes will be able to perceive, is an appearance like small fibres of gossamer adhering to the point of the paper. But if the light in any part of the room throws a shadow, this shadow, falling on the white paper under the specimen, will be much more visible. and more like an insect than the object itself is. And the magni-

fying glass shows this specimen to be quite perfect, the wings, tho long antennæ, like strings of beads, the feet, every part in fact, being hereby rendered beautifully distinct.

By the side of this invisible object, you will see the female fly of the wheat midge, glued upon a square slip of paper with its wings extended—whereby it is rendered much more distinct.

This fly, it will be remembered, deposits its eggs in the heads of the young wheat, from which hatch minute worms or maggots of a bright yellow color, which lie inside of the chaff, and in contact with the young soft kernels of the wheat, from which they abstract the nourishment, so that these grains or kernels become shrivelled and dwarfish. In addition to the male and female flies of the wheat midge, I have placed in the box several of the small yellow worms, taken from wheat heads, and glued to a slip of paper, and also, glued to another slip of paper, several kernels of wheat, shrivelled by this insect.

This is the same insect which, in many neighborhoods, is called the weevil — the most inappropriate name that could possibly be given to it, for the midge is no more like a *weevil*, than an eagle or a hawk is like an elephant. And to show how very dissimilar the two insects are, I have placed in the same box

The *grain weevil*, an insect which infests the dry, stored wheat, in the bins in granaries and warehouses, but never attacks it when it is growing in the field. The grain weevil originated in Europe and is quite common there, but is only occasionally met with in this country; an American insect very closely like it, named the rice weevil, being much oftener found with us, in wheat, in Indian corn, and other grains which have been long kept, as well as in rice.

In this *second box* you will see a specimen of the *Hessian fly*, of which I have already spoken somewhat fully; and also a specimen of the white worms or larvæ which hatch from the eggs of this fly, and several of the brown pupæ or *flax seeds*, as they are commonly called, into which the worms change after they get their growth. These worms and flax seeds are found at the roots of the young wheat plants in autumn and winter, and after the stalks shoot up, the following spring, a second brood of them appears, lying immediately above the lower joints, in the straw, weakening the stalks so that they break and lop down.

You will also see in this box, a specimen of the straw, thus broken, and showing several of the flax seeds imbedded in it.

In another box you will see specimens of the fly which produces the *joint-worm*, which of late years has wholly destroyed the wheat fields in some parts of Virginia—and instances have occurred both in our own State and in Massachusetts, of a closely similar insect infesting fields of barley, and greatly injuring them. But I have no knowledge of its ever attacking the wheat crop with us.

This joint-worm is so similar in its appearance, and in its operations to

the Hessian fly, that we should expect it to be an insect of the same group, a two-winged instead of a four-winged fly. Small white worms are found, lodged in little cavities in the straw, mostly at the joints, causing the straw to become swelled, uneven and knotty. In the same box you will also see a specimen of the straw, shaved off so as to show the little cavities in which these joint-worms lie, and also another piece of straw with one of these flies coming out of it—his black head protruding from the side of the straw, but so minute you will have to look sharp to see it. And on the upper side of this same straw are two small holes perforated, like pin-holes, from which flies have also come out and escaped.

In this same box you will also see three specimens of the *chinch-bug*, an insect which has of late years severely injured the growing wheat in Illinois and the adjoining States, totally destroying it in some fields. This insect is also common through the southern states. It punctures and sucks the juices from the young wheat stalks; and in dry seasons it becomes so multiplied that the stalks are crowded and black with them, entirely exhausting the stalks of their juices, and causing them to wither and die. And after the wheat is harvested they emigrate to the corn fields, bleeding the cornstalks in the same manner.

The parent insects of two of the most pernicious borers of our fruit trees, are placed in this fourth box—that of the apple and that of the peach tree.

That of the apple tree you will see is a cylindrical beetle of a tawny brown or butternut color, with two white stripes the whole length of its body. This beetle drops its eggs in the crevices of the rough bark, near the root, from which small worms hatch which bore through the bark, and reside between it and the wood the first year, and the second year they bore into the solid wood, greatly injuring and often killing young trees.

One or two facts may here be related serving to indicate the losses we are sustaining from this insect. In the year 1851, an agent of one of the nurseries in the central part of our State, canvassed the county of Washington, and disposed of trees to the amount of $10,000; nearly all of them apple trees. The estimate will be a moderate one, to say that half of the trees which were thus introduced have now been destroyed by this borer; many persons have lost every tree or almost every one that they planted. We thus have a loss of $5,000 from this insect in this one county—without taking notice either of the expense of planting and nursing the trees; or of the many trees in addition to these, which particular persons obtained from other sources.

A person visiting me a few months since, remarked, he would himself be willing to pay me a hundred dollars, if, by my researches, I would discover some effectual method of protecting apple trees from the borer; as this insect had occasioned him losses far exceeding the sum he named. Without claiming the reward he offered, I informed him I had already experimented and would give him the very remedy he wished; if he would rub the bark of his trees with soap, the latter part of May each year, I

would guarantee that not one of these borers would ever touch them. Some of the present audience will probably recollect how forcibly one of the most valued members of our State Society, the Hon. A. B. Dickinson, recommended this same remedy, at one of our annual meetings a few years since. Having had a favorable opportunity, I have since then tested this remedy to some extent, applying it to a part of my trees, and omitting it from others; and the following spring I have found young borers in almost every tree where the soap had not been applied—one tree only 3½ inches in diameter having fifteen in it—whilst not one could be detected in any of the soaped trees.

In the same box is also a male and a female fly of the peach tree borer—the two sexes being very unlike each other, as you will perceive. Like the apple tree borer, this fly places its eggs on the bark low down, at or near the surface of the ground, and the worms from them work downward in the bark of the root, causing the gum to exude profusely. In numerous instances peach trees are supposed to be winter-killed, when it is this borer in the roots that has destroyed them. This same insect works in the root of the plum tree also, when it cannot find all the peach trees it requires for its accommodation. When the worm gets its growth, it crawls up to the surface of the ground, and there surrounds itself with a kind of pod, formed of its chips and castings mingled with gum. A specimen of one of these pods you will see in the box. This pod is placed on the side of the root in a groove of the bark, with its upper end projecting slightly above the surface of the ground; and when the pupa lying in this pod is ready to give out the winged fly, it crowds itself upward out of the pod, its outer shell cracks open, and the fly crawls out of it.

The apple and the peach borers in their larva state, i. e. the large white grubs which are found under the bark of the apple and in the root of the peach tree, are so much alike in their size and appearance, that many persons believe them to be one and the same insect. But you will here see that they are the progeny of insects which have no resemblance whatever to each other.

Finally, in this box is the moth or miller of the apple tree caterpillar—the insect which comes abroad in July, and places the rings of eggs near the ends of the twigs of the apple and cherry trees, from which, the following spring, the caterpillars hatch, which form the large cobweb-like nests in the forks of the limbs of these trees. I exhibit these, chiefly, because these caterpillars are so common, and yet so very few persons have ever seen the moth by which they are produced. Also in this box you will see the cocoon which the caterpillars spin after they disperse themselves and wander away from the tree, out of which cocoon the moth afterwards comes.

In this box I have also placed two specimens of the *curculio*—a beetle, however, with the looks of which all the owners of plum trees are already familiar; as they also are with the little crescent-shaped slit which it cuts in the side of the young plum, dropping an egg into the wound, the worm from which feeds internally upon the fruit, rendering it worthless. And

so common has this insect become, that it is scarcely possible for us now to grow a crop of plums in any part of our State.

Why is it—the devout mind is inclined to ask—why is it, that Providence has inflicted upon us such numbers of these insect pests? But, when we come to take an enlarged, a philosophical view of this subject, we see that it is only incidentally that these creatures become detrimental to man, in subserving a most important work in the economy of nature. Their true office is succinctly stated by Linnæus, who styles *insects—the diligent and faithful servants of nature—perpetually engaged in destroying all that is dead, and checking the increase of all that is living in the vegetable world.* When we look at the work which they perform, we at once perceive its importance. Let us suppose a single one of our forest trees to grow and propagate itself without any check from its insect depredators. Schrank, an eminent German naturalist, in his work on the Fruitfulness of Plants, states that an elm, when twelve years old, produces 164,500 seeds in a single year. Now if none of these seeds were destroyed and none of the young trees which sprout from them, in the course of 12 years we shall have this number of trees, (164,500) of the same size with the parent, and almost two millions of smaller ones from the seeds of the intervening years. And each tree of this vast number becoming equally prolific, we see how speedily the whole earth would be monopolized by them. Incredible as it would at first thought appear, it requires but a few moment's calculation to show, that a person who in his youth saw but one single tree of this kind in our world, before old age came upon him, would see the progeny of this tree so vastly, so infinitely multiplied, that every rod of earth upon our globe would be occupied by them. And we thus see that we have need of every one of the insects which prey upon the elm, to repress its vigorous growth, to destroy its seeds, and to cut down the young trees which sprout from those seeds. None of them can be spared. If only a single one of the many kinds of insects which prey upon it were struck out of existence, we might well fear this tree would thrive and usurp such a place as would disturb the balance and mar the harmony which now exists in the domain of nature. We thus see that should a single minute insect of the vast multitude which we have, become extinct and disappear from our world—this one link being broken might produce a commotion in the whole length of the chain, and convulse the laws which regulate the natural world.

We at this time have in some parts of our country, an example of the manner in which a plant will thrive and extend itself when released from its insect enemies—a worthless weed which is rapidly overspreading whole fields, crowding out every blade of grass and every other plant. I refer to the *Antirrhinum* or *Linaria vulgaris* of botanists, known by the different names of snap-dragon, butter-and-eggs, toad's flax, &c. We have received this weed from Europe, and several insects I see are specified by European

*The *Calophasia Linariæ*, which wholly consumes the leaves from the stalks, the *Clisiocampa geographica, Cleophna Antirrhini, Eupithecia Linariata* and *pulchellata, Coremia ferrugata,* etc.

authors as subsisting upon it.* But in this country I cannot find a single insect or worm feeding upon this plant. Seldom even can a grasshopper, an insect which devours all kind of vegetation indiscriminately, be started up in the midst of a patch of these weeds, although they may be plentiful upon the surrounding herbage. And I am firmly persuaded that this weed thrives and usurps the place which it does, because it here grows without let or hindrance from any insect destroyers; and that this evil will continue, until by accident, or by the hand of man, some of the insects which prey upon this plant in Europe, are introduced upon this side of the Atlantic.

And we can now see why it is that insects become such pests to the agriculturalist and the fruit grower. It is their office to preserve a due balance in the vegetable world, and to check every tree and plant from extending itself and usurping a place which does not belong to it. Now it is the very aim of man to *destroy* this balance. It is the object of all his labors and toils. He sweeps away the forest trees which nature planted upon his lands; he exterminates the wild grasses and weeds which nature causes to spring up; he sows his grounds to wheat; it is his object to make this one plant occupy the land, to the complete exclusion of the hundred other plants which nature designed should diversify the same spot. Nature, as it were, resents this violence done to her arrangements, and seeks to restore the equilibrium and preserve the harmony which her laws require. And thus it happens that those insects which live upon wheat, whose office it is to check this plant from becoming too extended and occupying a greater portion of the earth's surface than belongs to it in the economy of nature—*these insects* attack and destroy this crop. It is nature's appointed way for preserving the balance in her domain, and preventing one of her subjects from overpowering others and crowding them out of existence. In one word, it is an instance of that

"partial evil, universal good,"

of which the poet sings.

And hence we see that the farmer's vocation requires something more than the plowing of his fields and sowing his seed. As he interferes with the arrangements of nature in doing this, nature will revenge herself, by sending her insects into his fields to destroy what he has sowed. He must learn to combat these or he will be subjected to most serious and vexatious losses. To render his pursuit successful, therefore, it is indispensable that he be acquainted with the different insects which prey upon the crops which he cultivates. He requires, as a first step, to know their looks, in order that he may recognize any one of them, that makes its appearance in his fields. And he requires to be acquainted with their history and habits, that he may be able to adopt suitable measures for frustrating their operations, and preventing the losses which, if unchecked, they are liable to occasion.

Many persons, on contemplating the myriads of these creatures with which our country and world is inhabited, in connection with their usual extreme minuteness, the obscure situations in which a large portion of them

lurk and the various ways by which they appear to place themselves nearly or quite out of our reach—many, I say, are inclined to despair of its being possible for man to resist them with any prospect of success. But I cannot think that Divine Providence has placed in our world any enemy of this kind, without also endowing man with sufficient intelligence to discover a remedy by which it will be practicable for us to frustrate or overpower that enemy. The more I examine these creatures the more confirmed I become in the opinion that there is no injurious insect in our world, but that, when we come to study its habits and transformations and become perfectly acquainted with all the details of its history, we shall be able to detect some assailable point and devise some measure by which either the insect can be destroyed or the vegetation on which it depredates can be shielded from its attacks. We shall discover that, although he may be invulnerable in every other part, no ægis protects his heel, and if we strike Achilles there, we inflict a death-wound.

From Trans. N.Y. State Ag. Soc. for 1868-9.

ADDRESS

OF ASA FITCH M. D., ENTOMOLOGIST OF THE SOCIETY,

ON THE CURCULIO AND BLACK KNOT ON PLUM TREES.

Mr. President and Gentlemen:

The Cureulio or Plum weevil and the Blaek knot excreseences on plum and eherry trees having been prominent in my investigations since I last addressed you, I have thought these would be as interesting as any subjeets I can seleet, on which to speak at this time. I am the more induced to make the Cureulio a prominent topie of the present leeture, sinee no partieular account of this important inseet has yet been given in my Reports on Noxious Insects, and may not appear for a while to eome, for the reason that I aim to introduee nothing in those Reports whieh has not been authentically ascertained by aetual observation, and an important portion of the yearly life of this inseet is yet remaining undiseovered and a subject of speculation and conjecture.

I am inelined to rank the Cureulio or Plum weevil as the most important and worst injurious inseet whieh we have in our eountry. Although the Wheat midge is at the present period eausing a mueh greater amount of peeuniary loss thau this inseet, I eannot but think that its eareer will be analagous to that of its predecessor, the Hessian fly, and that it will therefore in time become so fully naturalized and mastered by its parasitie destroyers, that it will cease to be the formidable evil whieh it now is. Unlike the Wheat midge, the Curculio is a native insect of our eountry, which has now been known upwards of a eentury, during all of which time it appears to have gradually multiplied and inereased its forces, without any eessation or intervals in its ravages. At first, in the eorrespondenee between the botanists Collinson and Bartram, in the year 1746, it is spoken of as totally destroying the neetarines in and around the eity of Philadelphia, whilst the plums it is said, were but slightly molested by it. But after a time, it took the plums also. As an evidenee of its steady progress and increase during the past forty years, I may state the faet, that iu my boyhood, the wild plum trees in my own vieinity were often well filled with fruit. But though thrifty trees are still growing in several of the same plaees, I have never sinee that time seen a ripened plum upon any of them. And now it has beeome so multiplied that the plum no longer suffiees to aeeommodate it, and it therefore attaeks our eherries and apples also, and a large portion of these are every year blighted and destroyed by it.

As already iutimated, this iuseet and its habit of destroying young plums, has been knowu iu our eountry, for more than a eentury. And so formidable an evil is it, that eommunieations without number, in relation to it

and remedies for its destruction, have appeared in our agricultural periodicals and other publications. You would hence think that everything relating to the habits and economy of this insect has been observed and made known to the public. This, however, is very far from being the case. Notwithstanding the volumes that have been written upon it, we do not to this day know where the Curculio lives and what it is doing, during three quarters of the year. All that is currently known respecting this insect is substantially as follows:—That it is a small grayish brown beetle, which makes its appearance on plum trees when the young fruit is about a third or half grown—cutting a curved or crescent-shaped slit upon the side of this fruit and dropping an egg into the wound—from which egg a small white worm hatches, which burrows in the fruit, causing it to wilt and fall from the tree—whereupon the worm crawls into the ground, to repose two or three weeks during its pupa state, when it comes out again, the latter part of July, a beetle like that which six weeks before laid its eggs in the fruit. What becomes of it from this time till the next June is wholly unknown. And that it breeds elsewhere than in the young fruit, though stated by some, is doubted and denied by others.

My own observations lead me to believe that what is currently known and supposed to be the main and essential part of the history of this insect, is in reality but a small part of its history—a mere incidental act—an episode only, of its life and operations;—and if there was no young fruit whatever, this creature would continue in existence without being sensibly discommoded by the want thereof. I will therefore proceed to state the facts relating to this insect, so far as they are at present known to me, and the inferences to which these facts lead me.

First, however, let us notice the insect itself. On taking one of them in hand and closely inspecting it, it is observed to lie perfectly still and motionless as though it were dead, and is seen to be a small, hard, uneven or knobby beetle, shaped somewhat like a pear, its anterior part being narrower than the main part of its body. It varies greatly in its dimensions, some of the males or smallest individuals being but half as large as some of the females; its medium size being somewhat less than a quarter of an inch in length. It is of a gray or rusty brown color, varied more or less in different specimens with spots of white, ochre yellow and black, in particular, showing a shining black spot on the middle of its back with a white spot immediately back of it. Hanging down conspicuously from its forward end like the trunk of the elephant, is seen a slightly curved beak or bill, of the same length and thickness as the thighs of the legs. This beak is an appendage which belongs to all insects of the weevil kind, and distinguishes them from all the other beetles or hard shelled insects. Being thus a true weevil this insect has often been termed the "plum weevil," and it is to be regretted that this has not become its current designation, it being so much more definite and expressive than the name "curculio," which is merely the Latin synonym of our English word weevil, and is hence applied in science as the family name of the whole group to which this species pertains.

Next, at what time do these beetles come abroad, and where do we find them? I know not how many articles in our agricultural periodicals I can refer to, reciting the success of different remedies, which were applied, "when the Curculio first began to appear"—yet not one of them specifying *the date*, whereby others might know when the time has arrived to look for it.

Undoubtedly to the south of us, in Pennsylvania and Maryland, this, like all other insects, will come abroad somewhat earlier than they do here in New-York. And everywhere, they will vary somewhat with the backwardness or forwardness of the season, in different years.

In my own vicinity, fifty miles north of Albany, this beetle has been found, as early as the beginning of April, though it is not usually met with till about the middle of May; and in a week or ten days afterwards it becomes common. It is then found standing or slowly walking upon the trunk and limbs of the plum, cherry, apple, the wild thorn-apple, the butternut, and doubtless on some other trees—though I name no others, not being certain but it was accidentally present in other situations where I have captured it. The collector of insects will notice, that the specimens he finds on butternut trees are always larger in size than those he finds on cultivated fruit trees—indicating that they have been better fed during the larva or growing period of their lives. And from this time, onward, till cold weather returns, we continue to find these beetles abroad, the whole season through. Late in autumn, upon the flowers of the Golden rod, they may be met with as plenty as at any earlier period of the year.

And next—what do these insects do? As we have just stated, they come abroad in full force, soon after the middle of May; and it is some two or three weeks after this, or about the tenth day of June, that the young fruit becomes sufficiently advanced to answer their purposes. They then fall upon it, to deposit their eggs therein. They are decided epicures, being most fond of the choicest varieties of our fruits; hence the nectarines and all the best kinds of plums are most sure to be destroyed. But as already stated, their numbers are now so excessively multiplied, all over our country, that the plums fail to accommodate but a portion of them. Others, therefore, invade the peaches, pears, apples and cherries, and others still attack the wild thorn apples, making the same crescent-shaped wound in all these fruits.

It is in allusion to this crescent-shaped mark that this weevil is frequently termed the Little Turk—as it appears to delight in seeing this symbol of Mahommetanism everywhere inscribed—as though the little imp was aware how annoying the sight of it is to us "Christian dogs."

This mark is scarcely the tenth of an inch in length, but is very distinctly to be seen wherever it occurs upon the surface of the young fruit. In apples, however, which are quite small and have a thin wooly coating and are increasing rapidly in size when they receive this wound, it in a few days becomes so dried and healed that it usually appears to the eye as a mere discolored speck, which is probably the reason why it has been so

much overlooked in this fruit. This mark is cut by the jaws of the insect, which are exceedingly small and are placed in the end of the long beak or trunk of which we have spoken. And in addition to this crescent-shaped slit, the Curculio wounds the fruit by drilling holes therein with its beak, resembling punctures made by a coarse pin or needle. One or more of these punctures may be seen upon almost every fruit which it invades. It is probably for feeding upon the juicy pulp of the fruit that the insect bores these small holes in it; and even where no crescent-shaped slit occurs, these perforations may be noticed, causing hard nurly dents to be formed in the fruit which would otherwise be smooth and fair.

Usually only one of these crescent marks is made upon a plum or apple, though sometimes two, three or more may be found. A single egg is dropped in each of these curved slits, and with its beak the insect crowds the egg deeply in to the bottom of the wound. From this egg a small white worm or grub hatches, which is destitute of feet, like the larvæ of all the other weevils, and is about four times as long as broad, being thickest in its middle, and with a small, shining, brownish yellow head. This worm penetrates inward to the core of the young fruit, and there feeds around the stone or seeds, excavating quite a large cavity, which is partly filled with small brown grains, the castings of the worm.

From the attack of this worm, the plum, the apple, the pear and peach, wilt and fall to the ground, whilst the cherry and thorn-apple do not wither but continue to grow and ripen, though so wounded, knotty and deformed, that the fruit is worthless.

And here let us pause for a moment, to notice one of those curious paradoxes, with which the student in the works of nature is so frequently meeting.

A person, on being informed that of the two stone fruits, the plum and the cherry, the one perishes and the other lives—of the two pomaceous fruits, the apple and the thorn-apple, the one perishes and the other lives, when invaded by this worm—I say, a person, on being informed of these facts, would at once say, it is the smaller of these fruits, it is the cherry and thorn-apple, that wither and die when attacked by this worm, whilst the larger fruits, the plum and apple, will feel the same injury less, and will survive the wounds that kill the smaller fruits. But lo! exactly the reverse of this is the fact. It is the small cherry and thorn-apple that live and ripen on their stems; it is the large plum and apple, and also the peach and pear that wither and fall from the tree! And on coming to consider this anomaly more fully, we clearly perceive that it is necessary that these things should be ordered and arranged just as we find them to be. The quantity of pulpy substance in the larger fruits is sufficient to feed the worm within them, till it reaches maturity; whereas, should the smaller fruits wither in the same manner, the worm within them would die. It is, therefore, necessary that they should continue to grow, to elaborate the amount of sustenance which the worm requires to bring it to maturity.

But why it is that in these several fruits effects so dissimilar result from the

same cause, these effects, too, exactly the reverse of what we should expect, we are wholly unable to explain. I can only resolve it into this, that in each of these cases, the Author of nature has decreed that it shall be so, and therefore it is so.

Even though in a more advanced state of science, the vegetable pathologist should be able to show certain peculiarities in the physical constitution of these trees, whereby it will be explained why it is that the irritation produced by the gnawing of this worm is speedily fatal to the one fruit, and not at all so to the other, it will only carry us one step further back and lead to the enquiry, How came these trees to possess their respective constitutions? Why did not the peculiarities of the cherry happen to be given to the plum, and thus produce a discord instead of that harmony which we now see?

And thus, wherever we fix our look in the wide domain of nature—whatever page we open in her "book of wondrous secresy," we perceive unmistakable evidence, that even in all its minutest details, the vast frame-work of creation has been arranged by a hand that was omnipotent, that hand guided by an intelligence that was infinite.

But to return from this digression. Any person on inspecting a large, thrifty plum tree at the commencement of June—on seeing the profusion of small young fruit which is everywhere interspersed among the leaves, would deem it all but impossible for an insect to devastate that fruit to the extent that the curculio does. He would think that, here and there, at least, a plum hid among the foliage, or projecting far out upon the ends of the slender twigs, would elude the search of this insect, and thus remain to ripen upon the tree But, I judge from accounts it is the same all over the country, that it is within the sphere of my own observation—although the trees are perfectly healthy and vigorous, richly clothed with verdure year after year, we never see a ripened plum upon them, except where special care is taken to combat this intruder.

And not only this fruit, but (what many persons are wholly unaware of) a large portion of our apples are also blighted by this same pest. I am persuaded it is one of the principal causes why our orchards at this day are so much less productive than they were a half century ago. To obtain a correct idea of the intolerable evil which this insect is in our country, I hope every one who now hears me, if he has not already particularly noticed the sad spectacle, will bear it in mind next 4th of July, or within a few days of that time, to walk to the plum trees and some of the orchards in his neighborhood. You will find the ground under many if not all the trees literally covered with the wilted young fruit that has fallen from its having been blighted by this insect. Could but a fourth part of what is lying on the ground have remained upon the trees to ripen, it would be such a yield from them, as for a cycle of years we have never had and have ceased to expect.

On cutting open these withered plums and apples you will find the same worm in the one as in the other, or if this worm has left a portion of the

fruit, its track will still be seen therein, demonstrating that the falling of the whole of the fruit, from both kinds of trees, has been occasioned by the same cause.

It is during the early part of July that these worms are leaving the fruit and entering the ground. But some are found still quite small, after others have got their growth and evacuated the fruit. Hence a considerable time elapses, two or three weeks probably, during which one and another of these larvæ in the fruit are coming to maturity and entering the ground.

They remain in the ground, reposing, in their pupa state, about three weeks. Hence it is during the latter part of July that the most of them complete their transformations, and come out again in their perfect state.

Thus, in from six to eight weeks from the time the egg is deposited, this insect gets its growth, and becomes a beetle of the same kind as its parent.

We thus have these insects completing their transformations and all coming abroad again in their perfect state the latter part of July. But there is now no young fruit for them to resort to. And the question arises, What do they now do, and what becomes of them from this time till young fruit again appears the following year? Where do they secrete themselves to pass the winter, and in what stage of their lives are they at that time?

Our best authorities at this day, give us as their opinion on this subject, that some of the larvæ which are retarded in completing their growth, so that they do not leave the fruit and enter the ground till the latter part of July or later, remain in the ground in their pupa state through the autumn and winter, to produce the beetles which appear the following spring. There are so many improbabilities connected with this view of the case, that I am surprised that an author so intelligent on these subjects, as was the late Dr. Harris, gives countenance to this as his opinion. Let us briefly look at this hypothesis. The temperature of the earth through the month of August is greater, the ground is then warmer than it is in July. There is no probability, therefore, that an insect whose transformation under ground is completed in three weeks in July, can remain in the earth a longer period in the month of August. Least of all is it to be supposed that it can remain there unhatched through all the warm weather of that month and autumn.

Again, we know that nearly the whole generation of these insects that is nurtured in the young fruit, reaches maturity and comes abroad the latter part of July. Now, is this vast army of these creatures merely an abortion—brought forth only to perish? Is the existence of this species left to the mere accident of a few individuals happening to be retarded beyond the usual time in entering the ground, and therefore remaining in it till the following spring? This would be an anomaly, wholly unlike anything which we meet with elsewhere in this department of nature's works.

Without stopping to notice other views that have been advanced on this subject, it may be observed, that the fact that these insects come abroad in the spring in full force, some three weeks before the young fruit is adapted to their use, and that after the young fruit is gone, they are

still abroad as numerous as before, the presumption becomes very strong, that they must have other places for cradling their young, in addition to the fruit. And the enquiry thus arises, whether the curculio is known to breed elsewhere than in young fruit. To this comes the reply, that there is one other situation in which it is well ascertained they do breed, with avidity, to wit, in those singular excrescences on plum and cherry trees, called the black knot. And as the curculio has so often been said to cause these excrescences, and the opinion is still entertained by many persons that they are produced by some other insect, if not by this, I may here turn aside to give some account of this remarkable disease—since, to ascertain whether it really was caused by an insect or not, I have examined it more closely, perhaps, than has ever been done by any other person.

This black-knot excrescence is a disease peculiar to the plum and cherry trees in this country. It is a large, irregular, black, wart-like excrescence, which grows upon the limbs, causing the death of all the limb above it, and extending down the limb farther and farther every year till the whole branch is destroyed, other limbs at the same time becoming affected in the same manner, and also the limbs of other trees in the vicinity. If it is neglected, it in a few years kills the tree.

This disease commences upon the small limbs, the wood of which is but a year or two old. It is recognized at first by a slight swelling of the bark at a particular point, on the upper side of the limb, which begins in autumn and remains stationary through the winter. When the sap begins to circulate in the spring this swelling increases, rupturing the cuticle or thin outer skin of the bark, and continuing to grow and puff out till in June some inches in length of the limb at the place affected is three or four times its diameter elsewhere. The bark and a portion of the wood under the bark are the tissues involved in this disease, both the bark and woody fibres being changed into a spongy substance, but not at all juicy like the fruit of a tree. This spongy substance is of a pale yellow color when growing, changing to coal black when it is mature; and then a minute black fungous plant, resembling the head of a pin grows upon its surface. You will see, on looking at these black knots, that their whole surface is covered and crowded with little smooth black granules, which are the fungus plant alluded to. They are a species of the genus *Sphœria*, and are described by that profound botanist, the late Rev. L. de Schweinitz, under the name *Sphœria morbosa*. It is a curious fact that the surface of these excrescenses, when mature, are always covered with this plant, which never grows, or at least has never been found, in any other situation.

There has been much speculation as to the cause and the true nature of these excrescences, they are so unlike anything else with which we are acquainted. Most persons suppose them to be of insect origin. The larvæ of the curculio are almost always found in them, and these larvæ consume nearly all of the spongy matter of the warts, but do not touch the little fungus growing on their surface, which remains, forming a kind of shell, after the whole inside is devoured. But as these excrescences are sometimes found

wholly free from the curculio larvæ and all other worms, it is obvious they are not the cause of their growth. Others have supposed they were analagous to the galls or swellings which we see on the limbs of oaks and other trees, and have even reported that a gall-fly is to be seen at times on these excrescences. But always in galls, one or more hard seed-like bodies are found in the centre, in which the young of the fly producing them is inclosed. Hence I know from their internal structure that these are not excrescences of that kind; and what the small fly is that has confirmed some persons in this error, we shall shortly see. Others still have maintained that it was a wound in the bark, made by the puncture of an insect, that caused this disease, some saying the remains of this puncture are often to be seen, when the first slight swelling in the bark begins. Yes, I have seen it. It is exactly as they state. Only it is not the puncture of an insect. It is one of the natural glands or pores in the bark, somewhat altered in its appearance, and rendered more conspicuous in consequence of the swelling. And it gives me the opinion that it is in this pore that the seeds of the disease are planted, or in other words, the contagion or poisonous matter which causes the disease here finds an entrance to the inner bark, which, thus tainted, begins to swell immediately around this pore.

I will not detain you to notice several other conjectures that have been presented to the public respecting the cause of this disease. Suffice it to say, that having now carefully examined these excrescences, from their first commencement, onward through their subsequent growth, I am prepared to say, with the fullest confidence, that the microscope shows nothing whatever about them, externally or internally, indicating that an insect has anything to do with causing them.

It has also been supposed that these excrescences were a peculiar species of fungus growing upon the limb; and there are some things about them which favor this view. But what is a fungus? To express it in familiar language—it is a body which grows, and forms its own substance, distinct from and independent of the body in which it takes root and from which it draws its sustenance. Now these black-knots are not such a growth. They are merely a change in the texture of the natural parts of the limb. And thus we arrive at the conclusion, that these excrescences are not of insect origin, and are not a vegetable fungus, but are properly a disease of these trees, whereby the natural tissues, the bark and wood, become softened and swollen, at the places affected.

In many respects this disease appears to be analogous to the cancer in the human body. And the most approved remedy for it, is the same as in that disease. It is *excision*. Wherever one of these swellings is discovered upon a limb, the limb should immediately be cut off, so far below the swelling as to be certain we remove every taint of the disease.*

* It is worthy of note, that in the discussion which occurred on the close of this lecture, Hon. A. B. Dickinson remarked that the black-knot only attacks trees growing in a wet subsoil, and if this soil be suitably underdrained, whereby, to adopt his expressive phrase, the trees

But, to return again to the *Curculio.*

We have the fact well authenticated, that this insect breeds in these black-knot excrescences, with about the same avidity that it does in young fruit—notwithstanding these substances are so unlike each other.

But the black-knots, like the fruit, have become too far advanced towards maturity, by the middle of summer, for these insects to resort to them to deposit their eggs therein. And the question thus returns upon us—What does the whole generation of these insects, which is bred in the fruit, and which comes out of the ground in their perfect state the last of July, now do, when there is neither young fruit, or black-knots to accommodate them?

Upwards of fifty years ago, Rev. F. V. Melsheimer, who was the best acquainted with insects of any man in our country at that day, stated that the Curculio was bred in the *bark* of peach trees, as well as in the fruit—but without giving any of the circumstances whereby he had learned this fact. And though no observations in confirmation of this statement have since been made public, that I am aware, I am strongly of the opinion that it is correct—and that these insects resort to the bark of different fruit trees to deposit their eggs, when they can find no young fruit to meet their wants.

Four winters since, Mr. L. B. Langworthy, one of the well known nurserymen at Rochester, N. Y., sent me a piece of pear tree limb, to examine a kind of scurf on the bark, which I found to be produced by a minute bark-louse, which I have described under the name of *Aspidiotus furfurus.* As I was passing the magnifying glass over the bark, I detected therein numerous curved incisions, of the same length and shape with the crescent-shaped marks made by the Curculio on the surface of fruit; and on the convex side of these incisions, the bark was elevated in a little, smooth blister-like spot. On opening these spots, a small cavity was there found, situated immediately under the cuticle or outer skin of the bark, in which, what appeared to be from four to six minute footless worms or maggots, were lying in a row, side by side, their tails towards the slit in the bark, and their mouths at the opposite edge of the cavity, ready to eat their way onwards in the bark, when the warmth of spring returned to awaken

will not have wet feet, none of these knobs will make their appearance upon them. On casting over in my mind the different localities where I have observed this malady, I am inclined to think it has been most prevalent and inveterate where either the surface or subsoil was of the character stated. But I have noticed some of these knots on thrifty plum trees in the garden of Hon. John H. Boyd, Whitehall, which was originally a naked rock sufficiently inclined for most perfect drainage, upon which a mellow loam has been drawn, to a depth of two to four feet. A. J. Heermance, Esq., of Rhinebeck, has also communicated to me the history of a Frost gage growing more than forty years in his grounds, and which had always been perfectly healthy until six years ago, when the black-knot attacked it. The affected limbs were promptly and perseveringly cut off, but without avail, the disease reappearing, till the whole tree was finally cut down, and yet last season the vigorous young sprouts from its roots showed the same malady clinging to them. It hence appears that though there is probably much truth in Mr. Dickinson's theory, it does not embrace the whole truth. The two cases here related favor the view of Elisha Derr, Esq., of Albany, that it is a rapid, exuberant growth of the trees that is the foundation of this and several other maladies.

them again into life. It was evident that the curved slit in the bark had been cut by an insect, which had dropped a half dozen eggs therein, the worms from which had fed on the outer layer of the bark directly under the cuticle, all eating in the same direction, and thus excavating the little cavity in which they were lying. They had travelled but little more than the length of their bodies, when cold weather came on to arrest their operations, for the time. The worms were so very minute—only 5-100ths of an inch in length—that no opinion could be formed from them as to what insect they were. But the size and shape of the incisions, together with the tree in which they appeared, suggested to me that they were the Curculio—and consequently that this insect commits its eggs to the bark, in which it lies, in its larvæ state, during the winter, to complete its growth and produce the beetles which make their appearance the following spring.

I will state one fact more in confirmation of this view, that these insects are reared in the bark. The Curculio is so frequently met with on butternut limbs, as to render it altogether probable that this tree is as much a favorite abode for it as is the plum and apple. And the larger size of the specimens found on the butternut, as has already been remarked, indicate that they have been better fed during their larva or growing state. This difference in size is so notable that some collectors have placed such specimens in their cabinets, as a distinct species. But, as many other weevils vary in their size to an equal or even greater extent, this cannot be regarded as a valid ground for regarding them as different. Now as no pulpy succulent fruit or other analogous substance occurs upon the butternut, it is a strong indication that this insect consigns its eggs to the bark of the limbs—which in this tree is remarkably thick and soft, its texture approaching the spongy substance of the black-knots.

Against this view that the Curculio is nurtured in the bark of trees, and there passes the winter in its larva state, it has been objected that it is contrary to all analogy, to suppose that an insect which feeds on young fruit should also feed on a substance so dissimilar as the bark of trees. But those who make this objection assuredly have but a limited knowledge of the habits of insects, and are unaware how diversified those habits often are, to accord with the different circumstances in which the insect finds itself placed at different times. One of the European insects which is most nearly related to our Curculio, both in its form and in its habits, we are told by Kollar, deposits its eggs in the new shoots of the plum when it cannot find fruit for this purpose. Moreover the dry spongy matter of the black-knot, is as much unlike the juicy young fruit as is the bark.

To sum up this subject, then—We see this beetle coming abroad with the first warm days of spring, individual specimens of it being found the last of March; and soon after the middle of May they appear in full force, and continue to be common from that time till the end of the season. As it requires but six or eight weeks for the egg to become a mature beetle, there are probably three or more generations of it every year—one individual after another coming to maturity and laying its eggs, whereby a con-

stant succession of new individuals are coming forth as the old ones disappear, through the whole season. They are committing their eggs to the bark of the different trees to which they resort, we suppose, at all times. And when the young fruit comes forward, its pulp furnishing a more tender and delicate repast to their young than the bark does, they for a time eagerly resort to it, to deposit their eggs therein. When the cold of autumn arrives it overtakes them in all stages of their growth. Some of the beetles newly hatched and with their stock of eggs not disposed of, it is probable crawl under stones and clods of earth, or among fallen leaves, or in the crevices of the bark of trees, and similar sheltered situations, and there lie torpid during the winter, as do many other species of the weevil family, to come out upon the first warm days of March and April. Others it is probable, when cold weather arrives have recently entered the ground to pass their pupa state. These pupa will remain in the ground through the winter awaiting the warmth of spring to enable them to complete their transformations. Others still are in their larva state, in all the different stages of their growth, in the bark, as we suppose, and also in late ripening thorn-apples, as we know. I may here state a fact which has not yet been mentioned. After the frosts of autumn have become so severe as to suspend all insect life for the season, the ground beneath some of our thorn bushes is found covered with fallen fruit, in which curculio worms are sometimes met with, these worms being then of all sizes. Such worms will no doubt remain torpid in the fruit through the winter, and awake to life the following spring, when, those that are full grown will probably enter the ground and complete their transformations, and those that are small will probably perish, as the fruit after having been frozen will scarcely nourish them onwards to maturity.

In view of the fact that our injurious insects are usually restrained from becoming excessively multiplied by their parasitic destroyers—other insects which are their most inveterate foes—you will be inclined to enquire, why do not the destroyers of the curculio fulfill their office better, and prevent it from being so exceedingly numerous and destructive.

This brings me to remark, that notwithstanding all the observations that have been made upon this insect, no other insect has ever been discovered, destroying this species and repressing its numbers, till within the past six months a species of this kind has been brought to light.

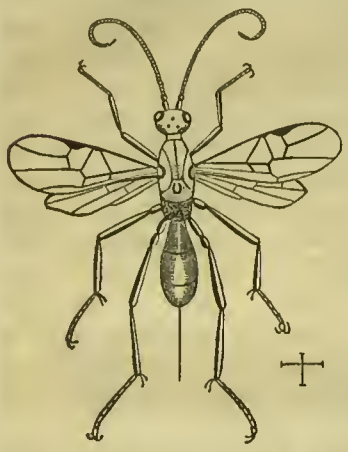
Mr. D. W. Beadle, of Saint Catharines, Canada West, sent to the Country Gentleman, specimens of a small four-winged fly, the history of which, as given in an accompanying letter, was as follows:—

Early in June, observing numerous worms in the young black-knot excrescences on the plum trees, he placed several of these excrescences in a jar of moist sand, tieing some thin muslin over the top of the jar. Early in July, curculio beetles began to make their appearance in this jar, and about a fortnight later, these flies began to appear in the jar also, and specimens of both the beetles and the flies continued to come out, till the 10th of August, the date when this letter was written. He suspected it to be a

gall-fly, and that if so, it might throw some light upon the cause and true nature of these excrescences. And it is altogether probable that this is the same insect which in some of the published accounts has been referred to as a gall-fly that is sometimes seen upon these black-knots, and was conjectured to produce them, as other flies of this kind produce the swellings on the limbs of oaks and other trees.

On examining these flies, I saw they were a parasitic insect, wholly different from, though having many points of resemblance to the gall-flies; and it having never been described, I gave it the name of the curculio parasite (*Sigalphus curculionis*) in an account of it, published in the Country Gentleman and also in the Albany Cultivator, in October last.

This insect, a magnified figure of which I present for your inspection, resembles a winged ant in its appearance. It is a small black four-winged fly, with bright orange-yellow legs, its hind feet and shanks being black. One of its most peculiar marks, (as you will notice on the figure) is, that the abdomen or hind body has only three joints, instead of six or seven, the number we usually see in insects. You will also notice, projecting from the end of its abdomen, a bristle-like sting. It is with this implement that it pierces the fruit or the black knot and punctures the skin of the curculio worm lying therein, at the same instant inserting an egg under the skin, the worm from which egg feeds in the interior of the curculio worm till it causes its death. Thus each one of these flies punctures and destroys probably more than a hundred curculio worms. It is therefore fervently to behoped that this insect may multiply and extend itself over our land, rendering us a service which no other instrumentality can accomplish.



Curculio Parasite, greatly magnified. The cross lines indicate its natural width and length.

It remains for us to consider the *Remedies* by which this insect may be opposed, and the fruit saved from its ravages.

In glancing over our agricultural publications, quite a number of these will be met with, none of which have gained the public confidence, and which it is therefore unnecessary to notice.

The remedy which has been much the most extensively resorted to, is one which has long been recommended and practiced against insects of similar habits in Europe, and which was brought into public notice in this country by the highly respected David Thomas, lately deceased. It was modestly proposed by him as a partial remedy, which might be resorted to with advantage until something more effectual is discovered.

It is the habit of this, as of all weevils and several other insects, when

alarmed or menaced with danger, to drop themselves suddenly to the ground, and there lie for a short time perfectly still and as though they were dead. The design of Nature, in giving these insects this habit, appears to have been, chiefly to protect them from being devoured by birds. A bird, in alighting upon a small limb, and hopping along it in search of insects thereon, imparts a slight jar to the limb, whereby all the insects on the limb are apprised of the approaching danger, and by instantly dropping to the ground and there lying perfectly still, they escape the impending destruction.

In view of this habit of the curculio, Mr. Thomas, as most of you are doubtless already aware, recommended the spreading of sheets under the tree, and then striking the trunk of the tree with a club or mallet, with a blow sufficiently heavy to give the whole tree a sudden jar—and then gathering up the insects that fell upon the sheets and destroying them—this operation to be repeated daily, or as often as the number of insects obtained showed its utility.

Some have been well pleased with the result of this remedy; others have been not at all satisfied with it, being unable to perceive that any good resulted from it, only a part of the insects dropping themselves when the tree is thus jarred—whilst the trees are much injured by this repeated striking, bruising and loosening their bark. Certain it is that this remedy is far from being so efficacious and reliable as to meet our wants in the premises.

A remedy which is at present receiving much notice, and is extensively on trial, is that of Mr. Cummings, of the N. Y. Observer, in which paper it has been strongly recommended for two season past—Mr. Cummings having found it perfectly successful, on a trial of it through two years previous to its publication. He mixed four ounces of sulphur with a pound of whale oil soap, and added this to four gallons of lime water, to which an equal quantity of tolerably strong tobacco water was then added. The leaves of the plum trees were drenched with this mixture, from a garden syringe, as soon the first mark of the Curculio was discovered on the fruit; and should rains occur within three weeks thereafter, sufficient to wash this from the leaves, it is to be renewed.

This remedy is not altogether so new as Mr. Cummings probably supposes it to be—for in the first published accounts of this insect over a hundred years ago, Colliuson recommends to Bartram, in the homely language of that day, to squirt tobacco water among the leaves of the trees to drive this insect from them.

We doubt not the whale oil soap is a valuable addition to the tobacco water. But whether the lime renders the mixture any more efficacious than it will be without it, we are inclined to doubt. And as to sulphur, although it has long been in popular repute as an antidote to all kinds of insects, we have yet to learn that it possesses any efficacy whatever in repelling or destroying any of this class of beings, save only the itch mite. Certain I am, that to the common apple tree caterpillar sulphur is more

beneficial than injurious—these caterpillars when their food is strongly impregnated with this substance, being more healthy and vigorous and coming to maturity a third sooner, than when it is not thus seasoned. My experiments on this subject, and their results, will be found fully stated, in the account of the apple tree caterpillar, given in my Second Report on Noxious Insects.

It is my opinion, therefore, that tobacco water with whale oil soap added to it, will be found equally as effectual as the more complex mixture of Mr. Cummings. One or the other of these as the testimony now stands, promises to be the most efficacious of any remedy yet brought to public notice.

One other topic connected with this branch of the subject merits to be adverted to before I leave this discourse. There is strong testimony to the fact that where trees are standing upon the margin of creeks and ponds with their branches extending over the water, they are not molested by this insect. A neighbor of mine, Peter Reid, Esq., who has an ardent predilection for observing our birds and their habits, and whose rambles in this pursuit have rendered him familiar with every part of the woodlands in his vicinity, informs me of a particular wild plum tree growing beside and leaning partially over a stream of water to which he has repeatedly repaired at the season when the plums are ripe, always finding it well filled with fruit, whilst a number of other trees are known to him, scattered about the woods, upon none of which has he ever been able to find a ripened plum. It hence appears that this insect possesses sufficient intelligence to be aware that if it commits its eggs to fruit which in falling will drop into water, its young will thereby be drowned; and it hence avoids the trees where this casualty will be likely to occur. It is therefore recommended to every one who has a stream or a pond of water upon his grounds, to plant his plum trees along its margin. And this fact has suggested a kindred measure, namely, the placing of water in large shallow tanks or tubs under the trees. Some limited trials of this kind have been mentioned to me as having appeared to be successful. But neither this nor any other remedy can be recommended and resorted to with perfect confidence, until its efficacy has been fully estblished by a carefully conducted series of experiments, or by the combined experience of several persons extended through a term of years.

From Trans. N.Y. Agr. Soc. for 1859

RAVAGES OF INSECTS ON FOREST AND FRUIT TREES—REMEDY.

The trees in the parks and gardens of this city having been seriously affected by insects, we sent to Dr. Fitch some of the limbs affected; and the annexed answer gives the remedy for these depredators. J.

JUNE 27, 1860.

Hon. B. P. JOHNSON:

Dear Sir—The "depredator upon the trees in Albany—very extensive"—of which you send me specimens—is a species of scale insect. The oval brown scale is the dried remains of the body of the female, which, adhering to the bark, covers and protects her eggs during the winter. When the warmth of the advancing season is about hatching the eggs, a white cotton-like substance begins to grow among them underneath the scale and protrude from one of its ends, elevating it from the bark—this cotton serving to protect the tender young insects till they become sufficiently robust to endure a full exposure to the atmosphere. The newly hatched insects resemble exceedingly minute lice. Each of these little masses of white cotton which are adhering along the under sides (as I suppose) of the limbs, may now be seen, by the aid of a magnifying glass, to be thronged with these lice, or with eggs not yet hatched. After a while, the lice will forsake this covering and disperse themselves over the bark—particularly the smooth tender bark of the small limbs and twigs—nourishing themselves by puncturing it and sucking the sap therefrom.

All kinds of these scale insects are most pernicious to the trees or other vegetation on which they occur. The apple tree bark louse—the minute oyster shaped scale, so common on our apple trees—is the species with which we have had the most experience; and it is altogether probable that any remedy which is effectual for it, will be equally efficacious for all other scale insects, including this now on the Albany trees. In the Memoirs of the old Board of Agriculture of our State, vol. iii, pages 535–539, is copied from the Memoirs of the Caledonia Horticultural Society, an article by Sir G. S. Mackenzie, on anointing the bark of trees with oil, to destroy insects thereon, alluding particularly to the apple tree bark louse. And in Illinois and Wisconsin, where of late years this insect has been unprecedentedly fatal to their orchards, and where every remedy which could be thought of has been tried, with but indifferent if any success, it is now reported that smearing the bark with oil—the same measure so long ago

noticed by Mr. Mackenzie—has been found to be a sovereign cure for this malady. I doubt not but that by it many of your Albany trees may be saved, which will otherwise perish. Fish oil, or any other kind of oil or grease, thinly applied, everywhere over the bark, so that its glossiness, is merely perceptible, is all that is required.

Messrs. Ellwanger & Barry have also sent me specimens of this same insect, as being abundant upon the maples, especially the soft maples, at Rochester. It is, therefore, very common at this time, probably, over a large portion of our State. In former years, I have occasionally met with single specimens of this scale on the trees here, in Washington county. An insect of this same kind occurs upon the maple in Europe, and is named *Lecanium Aceris* by entomologists. The fullest account of this insect which I have seen is in Curtis's British Entomology, where it is stated that "a white, flowery-like matter, in which the minute young are to be observed," grows underneath the scales. As it is a fibrous, cotton-like matter, not at all pulverulent like flour, which our insect grows, I think it is a distinct species from that of Europe, and have, therefore, named it in my manuscripts, *Lecanium Acericorticis*, i. e. the maple bark scale insect.

Yours truly,

ASA FITCH.

that gives three gallons per day, and I think by fall she will increase that quantity materially. They are very difficult to fatten while giving milk—the food seems to go to milk instead of flesh. The time for taking on flesh is while with calf, and until calving. Occasionally the udder has to be stripped or milked, some days before calving, owing to great distension of the bag—this is more especially so with a cow with her third or fourth calf. They are easily fattened in the absence of milking; very kind and easily broke; generally of a red color, and always small. They do finely on cotton seed as a food, mixed with bran or meal, together with hay or shocks. I have taken from one of this stock ten gallons per day; from another, eight gallons per day; from another, seven gallons per day; and now I have some five that will give six gallons a day of fine rich milk. I am unwilling to milk any cow that will not give me three gallons per day when in health and order. I regard, however, four gallons round to each cow, after supplying the calf, as being a very good average for my cattle. I keep all my cattle enclosed, and do not let them run out with any other cattle—hence I know my stock to be pure. F. HODGES.

The origin of this breed of cattle owned by Mr. Hodges is probably to be traced to Short-horn cattle imported into Virginia as early as 1783. In Allen's American Herd Book, vol. 1, p. 73, under the head of "the Short-horns in America," Mr. Allen says: "We are informed by Dr. Samuel D. Martin, of Colbyville, Kentucky, that as early as 1783, there were Short-horn cattle imported into Virginia. Some animals of this importation were called the 'milk breed,' and some the 'beef breed'; and in 1785, one of the Mr. Pattons brought to Kentucky a half-blood bull of the 'beef breed.' In 1797, old Mr. Patton brought to his residence in Clarke county, Kentucky, a bull and cow directly descended from imported stock, of what was then called the 'milk breed' of cattle; also some half-blooded cows of both the milk and beef breeds. The beef breed were long-horned cattle, large, coarse and rough; coming slowly to maturity, and fattening badly, until full grown, and were tolerable milkers. The milk breed were short-horned cattle, coming earlier to maturity and fattening more kindly. Their milking qualities were extraordinary. It was not at all uncommon for cows of this breed to give thirty-two quarts of milk daily. Mr. Patton's Short-horn

bull was called Mars; his cow Venus. The cow died, leaving only two calves, both bulls. The produce of Mars was spoken of by our old breeders in the highest terms, being superior both for beef and milk.

"In 1803, Mr. Daniel Harrison of Clarke county, Kentucky, purchased of Mr. Miller, of Virginia, a bull called Pluto, of the milk breed. Messrs. Welton & Hutchcroft also brought to Kentucky a bull called Shaker, of the milk breed. Capt. Wm. Smith also brought to Kentucky a very large bull called Buzzard, a mixture of the milk and beef breed. Messrs. Cunningham and Inskeep brought to Kentucky two bulls of this breed; in one, the beef, and in the other the milk breed appeared to predominate. The descendants of all these cattle were called in Kentucky the *Patton stock.*" J.

WORM ON GRAPE VINES.

FROM DR. ASA FITCH, SALEM.

Hon. B. P. Johnson:

Dear Sir—The worm on grape vines, from E. M. Bradley, of East Bloomfield, is the larva of Abbot's hawk-moth, *Thyreus Abbotii* of Swainson. I have occasionally met with this worm on grape vines, and oftener on the woodbine (*Ampelopsis,*) but have delayed introducing it in my Reports on Noxious Insects, in the hope of becoming more fully assured with respect to its transformations. Swainson, from a figure made by Abbot, represents this worm as having a tail-like horn at the end of its back, in place of the glassy eye-like spot which you doubtless noticed on it if you opened the box in which it was sent. Hence Dr. J. P. Kirtland, of Cleveland, Ohio, (in Proceedings of Philad. Acad. Nat. Sci., 1857, p. 148,) has pronounced Abbot's figure erroneous. But I think I have seen this worm with the horn as represented by Abbot, and that this is the normal form of the *young worm*, and that with the last change of its skin, it loses the horn, and the eye-like spot then comes in its place. It was with the hope of becoming perfectly assured upon this point, that I have hitherto refrained from reporting this species, with the habits of which I have been acquainted for many years.

I do not think this worm ever attacks the fruit. In the box sent, the leaves are all brown and withered, and the worm appears gaunt and hungry, and yet none of the fresh-looking green grapes in the box are in the least gnawed; a strong evidence

that it feeds on the leaves only. I have known a grape leaf five inches in diameter to be more than half consumed by one of these worms in a single night.

The following brief description and history of this insect will, probably, suffice to render it definitely known:

The worm appears in July, and grows to about three inches in length and half an inch in thickness. It has a tesselated or checkered appearance, from numerous short, blackish, longitudinal stripes, between the fine wrinkles or transverse striæ of its body, its ground color being ash gray, usually tinged with red on the under side and legs. It finishes feeding and quits the vines the fore part of August, crawling deep into the ground, beyond the reach of frost, Dr. Kirtland says; but in repeated instances in which I have bred it, it has merely crawled under dry leaves or other rubbish on the surface of the ground, surrounding itself slightly, if at all, with a few loose threads of silk, and reposing in this situation, in its pupa state, till the following May, when it hatches a very thick-bodied humming-bird moth measuring about two inches and three-fourths across its extended wings; its color being deep bluish gray, varied with velvety black bands, and oblique streaks on the inner part of its wings, and particularly distinguished by having the anterior half of its hind wings of a bright lemon yellow color. These moths place their eggs upon the leaves, from which come another generation of the worms.

The only measure I am able to recommend for destroying this and a few other kinds of large worms which occur upon the grape, is, to pick off every leaf on which a worm is discovered, and crush it beneath the sole of the boot. Fortunately, none of these worms are liable to become multiplied and numerous, nor are they at all venomous, as is popularly imagined. No special solicitude need be excited, therefore, from meeting with one or another of them, occasionally among the leaves.

August 8, 1860.

THE WHEAT MIDGE PARASITE.

We take the following from the Canadian Agriculturist, published at Toronto, July 16:

A correspondent of the London Free Press writes: "I am rejoiced that this week I announce the arrival of a deadly enemy to the wheat maggot or fly; in the neighborhood of Sparta, town-

ship of Yarmouth, the farmers discovered another species of ichneumon, which deposit their eggs in the larvæ. One of these is very small, black and shining; the other is also black, with red feet and blunt tail. These are often mistaken for the wheat fly; but as it has only *two* wings, while they have *four*, the distinction is obvious. To observe the proceedings of the ichneumons, place a number of the larvæ of the wheat fly on a sheet of paper, and set a female ichneumon in the midst of them; she soon pounces upon her victim, and intensely vibrating her antennæ, bending herself obliquely, plunges her ovipositor into the body of the larvæ, depositing in it a single egg. She will then pass to a second, and so on, depositing a single egg in each. You will observe the maggot writhing in seeming agony, when sometimes the fly stings them three times.

"These ichneumons appear in myriads on the outside of the ear; but, as impatient of bright light, sheltering them from the sun's rays among the husks."

ESSAY ON PLEURO-PNEUMONIA IN CATTLE.

To the Gentlemen of the New York State Agricultural Society:

Gentlemen—From our newspapers, I see that fatal disease pleuro-pneumonia has reached your State, and no doubt will be as bad as it has been in many countries it has passed through in its progress for the last twenty years, at least, westwards. The first we heard of it, was that it broke out among the cattle following the Russian armies when they invaded Turkey. That invasion terminated in the treaty at Adrianople—their army being so reduced by disease among men, horses and cattle, they could proceed no further, though Constantinople was almost in their grasp—it spread on their return through all the countries they passed. Hungary was the first country from which we had accounts of it—in it the cattle were nearly annihilated. It gradually came westward, was many years before it reached Holland; prohibitory laws were passed by the Russian, French and other governments, to prevent the introduction of cattle, skins, hair, &c., into their territories from the adjoining countries where the disease existed. Most of the skins found their way to England. During the time it was prevalent in Holland, the Secretary of the Highland Agricultural Society of Scotland, had communications with the Board of Trade on the importation of diseased cattle, (the tariff being altered, and free importation allowed,) but that

Dutchess; Herman Wendell, Albany; Oscar Granger, Saratoga; Solon D. Hungerford, Jefferson; Thomas I. Chatfield, Tioga; Patrick Barry, Monroe; Samuel W. Johnson, Cattaraugus.

Corresponding Secretary—B. P. Johnson, Albany.

Recording Secretary—Erastus Corning, Jr., Albany.

Treasurer—Luther H. Tucker, Albany.

Executive Committee—T. C. Peters, Genesee; E. Sherrill, Ontario; A. Hubbell, Oneida; C. I. Hayes, Otsego; W. Newcomb, Rensselaer.

A recess was then taken until 7 P. M., when, after the presentation of some resolutions by Mr. Johnson, on behalf of Mr. P. M. Wetmore, of New York, which were laid on the table for discussion by the Society at their meeting on Thursday, the annexed valuable letter was read from Dr. Fitch, Entomologist of the Society, who was unfortunately prevented by illness from being present in person:

INSECTS THE PAST YEAR.

DR. FITCH'S LETTER.

Gentlemen—The past year has furnished an unusual amount of important material for investigation in the department in which I am occupied. And I had contemplated with much satisfaction the account of the year's researches which I should have to present in this address at the annual meeting. I will endeavor to hastily sketch the leading topics I had intended to speak of, and if you deem this will be of any interest to the meeting, it may be read as some amends for my non-appearance.

The insects with which my attention was most occupied the past year, were the *Grain Aphis*, the *Army Worm* and the *Wheat Midge*. And I will aim to notice some of the more important facts that have been thus come to with respect to these insects.

The first of these, the *Grain Aphis*, made its advent in a most remarkable manner. That an insect never seen before, and not known to be present in our country, should suddenly be found everywhere in New England and most of the State of New York, in profuse numbers in every grain field of this wide extent of territory, and literally swarming upon and smothering the crop in many fields, was a phenomenon which probably has no parallel in the annals of science. How it was possible for this insect so suddenly to become thus astonishingly numerous, was a mystery which seemed to most persons to be inexplicable. It is the most

prolific of any insect which has ever been observed. I find it commences bearing when it is but three days old, and produces four young daily. Thus the descendants of a single *Aphis* will, in twenty days, amount to upwards of two millions, each day increasing their number to almost double what they were the day before. This serves to account for the surprising numbers which we had of this insect.

The *Aphis* was everywhere supposed to be a new insect, and one writer went so far as to name and describe it scientifically, in full confidence that the world had never before known anything like it. My examinations, however, fully assured me that it was identical with a species which has long been known in the grain fields of Europe. And on my announcing this, the erroneous views which one and another were adopting, were speedily abandoned.

Our best European accounts of this insect, however, are very imperfect. They only speak of it as occurring in June and July, whereas I find it is present on the grain the whole year round. And when the grain is but a few inches high, if half a dozen of these insects happen to locate themselves on the same plant, they suck out its juice to such an extent that the plant withers and dies.

As yet I have never been able to find a male of this species. They are all females. This is proved by placing any one supposed to be a male in a vial; next morning two or three young lice are always found in the vial with it. The general habits of insects of this kind are well known. The *Aphis* on the apple tree and other fruit trees, when cold weather arrives, give birth to males. The sexes then pair, and the female thereupon deposits eggs, which remain through the winter to start these insects again the following year. I had supposed it would be the same with this *Aphis* on the grain. I thought, when autumn arrived, I should meet with males and find eggs dropped on the blades of the grain. But there were none. The females and their young continued to appear on the grain till the end of the season. They are everywhere on the grain now, buried under the snow, ready to warm into life and activity again when the spring opens. And on grain growing in flower pots, on which I am keeping these insects in full activity through the winter to notice what I can of their habits, no males have yet appeared. When, and under what circumstances this sex will be produced, is a most curious

subject, still remaining to be ascertained. It at present looks as though the female and their descendants were prolific permanently, without any intercourse of the sexes.

Last summer, such multitudes of parasites, lady-bugs and other destroyers of this *Aphis*, had become gathered in the grain fields at harvest time, that it seemed as though it would be exterminated by them. But at the end of the season, this insect appeared as common on the young rye as I had noticed it at the opening of spring. The present indications, therefore, are, that this *Aphis* will be as numerous on the grain the coming summer as it was the past, if the season proves favorable to its increase.

As to the *Army Worm*, it may be remarked that for almost a century it had been known that in this country was a kind of worm whose habit it was to suddenly appear in particular spots in such immense numbers as to wholly consume the herbage over an extent frequently of several miles, and then abruptly vanish, nothing being seen of it afterwards. Thus it was one of the most singular and also one of the most formidable and alarming creatures of this class that was known to be in our world. Yet, what kind of worm this was, and what insect produced it, remained wholly unknown down to the present day. Appearing here and there all over the country, the past season, this *Army Worm* became an object of the deepest interest; and from Illinois on the one hand, and Massachusetts on the other, specimens of the moths bred from these worms were sent to me, for information as to what the name of this insect really was. To these inquiries I was able to give an answer so full and explicit that there has been a general acquiescence in the correctness of my decision of this subject.

With regard to the *Wheat Midge*, I would observe that, in a lecture before the Society a few years since, I stated that in this country injurious insects were much more numerous than in Europe, occasioning us far greater losses than are there experienced. I was assured of this fact from carefully comparing the statements of foreign authors respecting the depredations of particular insects, with what we know of the same insects here. But I did not suppose it would be possible to show by any more decisive proof that the facts were as I stated. A year ago, however, I received from France a vial filled with insects as they were promiscuously gathered by the net in the wheat fields of a district where the *Midge* was doing much injury. It then

oeeurred to me that, by gathering the insects of our wheat fields here in the same manner, it would furnish materials for a very aeeurate comparison of the wheat inseets of this eountry with those of Europe. As the result of a comparison thus made, I find that in our wheat fields here, the *Midge* formed 59 per cent. of all the insects on this grain, the past summer; whilst in Franee, the preceding summer, only 7 per eent. of the insects on wheat were of this speeies. In France, the parasitic destroyers of the *Midge* amounted to 85 per cent.; while, in this eountry, our *Parasites* form only ten per eent. And after the full investigation of the subject which I have now made, I can state this fact with confidence: we have no *Parasites* in this country that destroy the *Wheat Midge.* The insect so common on wheat, and which resembles the European *Parasites* of the *Midge* so closely that, in the New York Natural History, it is deseribed as being one of that species, and in the Ohio Agricultural Reports it is confidently set down as another of them, I find has nothing to do with the *Wheat Midge*, but is the *Parasite* of an ash gray bug which is common on grain and grass, laying its eggs in the eggs of this bug, and thus destroying them.

In my lecture a year ago, I stated to the Soeiety that the *Wheat Midge* had wholly vanished the previous summer; not one of its larvæ could I find, on a careful search, over an extensive distriet around me. But the past season this insect appeared in the wheat again as numerous as usual. This has led us into important changes in our views of the habits of this inseet. How was it possible for it to utterly disappear from the wheat one year, and be back in it in swarms the next year? Obviously it must have other plaees of breeding than in the wheat. And, therefore, if no wheat was grown in this country for a few years as has been so often proposed, it would not starve and kill out this insect. The insect would resort to these other situations, and would sustain itself there, returning into the wheat again as numerous as before, when its cultivation was recommeneed. And what could it be that banished this insect from the wheat in 1860, and brought it baek again in 1861? The remarkable differenee in the weather of these two years furnishes an answer to this question. When the *Midge Fly* eame out to deposit its eggs in June, 1860, the weather was excessively dry; in 1861, it was very wet and showery. And thus we learn the fact that these flies eannot breathe a dry, warm atmosphere; they are

forced to retreat to places where the air is damp and moist. When the uplands, the ploughed fields, are parched with drouth, the *Midge* cannot abide in them; it must go to the lowlands along the margins of streams, where it must remain so long as the drouth continues. Here it must lay its eggs and rear its young, depositing them probably in the grass growing in these situations.

And, hence, we also learn, that if the last half of June is unusually dry, our wheat that year will escape injury from the *Midge;* but if the last half of June is very wet and showery, this crop will be severely devastated. Time forbids my pursuing this subject further.

ASA FITCH.

The President, Mr. Geddes, then introduced Hon. Henry S. Randall, of Cortland, who was present at his request to read a paper upon sheep raising and wool growing. Mr. R. occupied upwards of an hour in a summary review, particularly of the Fine Wooled Sheep of the country, their introduction, character and successful improvement. This paper included several extended tables, and much information gathered from the previous writings of the author and others, as well as by his recent observations in this and other States, and by correspondence with our best sheep breeders. Biased strongly in favor of the fine wooled breeds, few advocates of that class of sheep could have made out a stronger argument in its favor.

At the conclusion of Mr. Randall's essay, Hon. Wm. Kelly, of Dutchess, seconded by Mr. Peters, moved a vote of thanks and that a copy of the paper be requested for the Transactions of the Society. Adopted.

The essay of Mr. Randall will be found among the valuable papers prepared for the Transactions.

The subject of the location of the State Fair for 1862, for which there were proposals, was referred to the Executive Committee.

The Society adjourned to meet at the Agricultural Hall on Thursday.

THURSDAY, *February 13th.*

The Society met at the Agricultural Hall, lecture room, President Geddes in the Chair.

DISCUSSIONS.

ANALYSES OF SOILS.

The following preamble and resolution (introduced the previous evening by Prosper M. Wetmore, of New York, and laid upon the table,) were taken up:

Whereas, It is of the first importance to the agricultural interests of the United States to be possessed of the best information which the science and skill of the country can command, of the deterioration of the soils of the several States, from cultivation, and also of any remedies which may be known, to lessen or counteract such deterioration; therefore,

Resolved, That the Commissioner of Patents be requested to procure and report to Congress analyses of the arable lands of the United States, showing the percentage of proximate organic and inorganic fertilizing elements contained in their cultivated depth; also, the annual yield of the same crop on the same soil from the first to the latest cultivation; also, the estimated amount of fertilizing material in crops annually exported from the United States.

On reading the preamble and resolution, Mr. Geddes remarked that he did not believe the soils of the country were deteriorating—hence the basis of the resolution was erroneous. In Mr. G.'s opinion our soils were increasing in fertility, rather than deteriorating, as assumed by Mr. Wetmore, and gave cogent reasons for the opinion expressed. He trusted the Society would not endorse an assumption so fallacious as that embodied in the preamble.

Mr. Wm. Newcomb, of Rensselaer, said that from forty years' experience as a practical farmer, he was of opinion that our soils were *not* deteriorating, as assumed, and therefore opposed the resolution. He had little or no faith in the analysis of soils as a remedy, even if the assumption of deterioration were true, as his experience led him to believe that little dependence could be placed upon analyses.

Hon. A. Osborn, of Albany, did not believe our soils were deteriorating, nor, if they were, that analyses would prove reliable. The Judge related some of his experience in analyzing soils; that he found a similar result in testing both poor and rich soils, and concluded that proper cultivation, the liberal use of the plow and hoe, must be the main dependence.

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interest asserted its rights in this matter. The nation recognizes the necessity for a higher standard of education for farmers, and has generously provided for it. The parents of those who are to become farmers must recognize the same necessity, and husband well the resources which the nation places at their disposal, attesting the wisdom of Congress in the annual improvement of the farmer and the farm, and the higher elevation of the agricultural profession.

The act of the last session of Congress, donating public lands to the several States and Territories which may provide colleges for the benefit of agricultural and mechanic arts, provides a quantity equal to 30,000 acres to each senator and representative in Congress to which the States are entitled by the apportionment under the census of 1860. New York, having thirty-three senators and representatives, is therefore entitled to 990,000 acres of land, which, if sold at the established Government price of one dollar and a quarter per acre, will create a fund of $1,237,500, which the State is bound by the act to protect and keep good as a perpetual fund, which "shall be invested in stocks of the United States, or of the State, or some other safe stocks, yielding not less than five per centum on the par value of said stocks." This will produce an annual income of $61,875, to be applied "to the endowment, support and maintenance of at least one college, where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts," which, if faithfully administered, will do much to place the agricultural student on a level with those of other professions. This is a high trust confided by the nation to the farmers and mechanics of our country, and they must see to it, that it is not diverted from its proper channel, nor impaired in its usefulness by subdivisions among weak and inefficient institutions.

It is a proper and legitimate duty of this Society to foster the cause of agricultural and mechanical education, and watch with jealous care the appropriation of this National College fund, to the end that it is not perverted from the lofty purposes for which it was set apart by Congress.

In drawing my official labors, as the President of your Society, to a close, I feel it incumbent upon me to express my sincere thanks to my immediate predecessor, the Hon. George Geddes, and to the gentlemen of the Executive Committee, for their efficient support and co-operation in conducting the affairs of the Society, and carrying it successfully through the past year, and especially during my absence from the country.

I am under like obligation, and embrace the present occasion to tender my thanks to the Board of Managers of the Monroe County Agricultural Society, the Common Council of the city of Rochester, and many of the distinguished citizens of Rochester, for their generous and efficient aid in making preparations for and in conducting our last annual fair to a successful issue.

Regretting that it has not been in my power to render more valuable services to the Society during the past year, and pledging my future co-operation in whatever may tend to advance the interests of the Society and the cause it has at heart, I turn with satisfaction to the performance of my last official duty, the introduction of my successor, Mr. Edward G. Faile.

AGRICULTURAL DISCUSSIONS AT THE STATE FAIR, ROCHESTER, 1862.

On Tuesday evening, September 30, *Dr. Asa Fitch*, Entomologist of the Society, delivered an interesting lecture on the *Aphis*, which has been so destructive to the crops of oats, spring wheat, barley and rye. The farmers present had many questions to be answered, and the discussions which arose after Dr. Fitch had concluded his remarks, were very interesting.

Hon. A. B. Conger, ex-president, who was chairman of the meeting, pursuant to a resolution of the meeting, prepared and published a summary of the conclusions arrived at, on the subjects discussed.

THE APHIS.

1. It is a general law of nature, that insects injurious to vegetation have their parasites and other natural enemies, which are sooner or later developed in sufficient numbers to exterminate the race they feed upon.

2. The aphis avenæ, the insect which, during this season and the last, has destroyed large crops of oats, spring wheat, barley and rye, is undeniably of the louse species, having almost incredible powers of fecundity, developing from a single female, and without the intervention of the other sex, over two millions in twenty days.

3. Its enemy is of the lady bug species, perfectly harmless itself to vegetation, but an active poison, probably, to the domestic animals, should they be turned upon the stubble too soon after harvest, when the lady bug or coccionella has finished its attack upon the aphis.

4. The aphis is unlike the midge or Hessian fly, in the above particulars, except in the general characteristic of their being severally provided with the parasitic destroyers, and in having their ravages limited by conditions of the atmosphere and of heat and moisture, which are not clearly defined in some cases by early maturity, and by constitutional peculiarities in certain varieties of seed which possess a greater toughness of the pericarp, or outer covering of the seed.

5. The practical question which remains for the farmer is to determine whether he may not, by careful selections of seed, and by a more thorough tillage and judicious application of plant-food, develop his crop, so as by increasing its constitutional vigor and in effecting an early maturity, to render it a less easy prey to the ravages of any of the insect tribe now known, or that may hereafter be discovered.

Benefits of Underdraining.

On Wednesday evening, October 1st, the benefits of underdraining elicited a very animated discussion, the substance of which we give in addition to the very valuable summary by Mr. Conger, which embodies the

conclusions arrived at by the very intelligent farmers who were present in large numbers.

1. The principal benefit to be secured to the farmer, by underdraining, lies in the more *thorough tillage* he is able to give his *arable* land; yet instances are not wanting, where *pasture lands* are very profitably improved from what may be denominated the *primary* or simple method of draining.

2. In the discussion of this subject, soils are properly divided into those which produced, to a greater or less extent, *aquatic*, and those which bear the *cultivated grasses;* the former being nearly destitute of nitrogen, or the flesh-forming principle.

3. As the supply of nitrogen for plants is mostly derived from the atmosphere, soils not possessing the natural or artificial means of drainage for the surface water, or that welling up from the stratified subsoils, are unable to allow the atmospheric air to circulate in them, and cannot absorb any portion of its nitrogen, and are generally regarded as barren or waste land.

4. The average annual fall of water in the State of New York, in the form of rain and snow, is within a fraction of three (3) feet, of which only one twenty-fourth (1.24) is appropriated by plants; seven-twelfths (7.12) pass off by evaporation, and three-eighths (3.8) are carried away by water-courses, either open or moving beneath the earth's surface.

5. Where these water-courses are deficient in number, imperfect in flow, or obstructed in their outlet, the first essay of the drainer is to remedy these defects; and where the adjacent land is porous in its character, as in the case where sandy particles predominate, the simple ditch, judiciously located, is sufficient to provide for the escape of all surplus water.

6. Where, in addition to the annual supply from the skies, the soil is saturated with water boiling up from the stratified subsoil, or underlying or adjacent rocks, it is then expedient, by *boring*, to conduct the excess of this supply to the main ditch directly, or by lateral drains leading into it.

All these methods may be classed under the primary method of drainage.

7. In soils deficient in, or wholly deprived of, sandy or porous constituents, the escape of the twenty-three twenty-fourths (23.24) of the rain and snow fall is retarded, the average temperature of the soil is lowered by six and a half degrees ($6\frac{1}{2}°$) of Fahrenheit's scale, equal to seven degrees (7°) of higher latitude, and the water forced up from the fissures of adjacent stratifications (if any there be,) make the receipts of a more thorough system of drainage, which may be styled the secondary or complex method.

8. In proportion to the density and tenacity of the soil, ditches must be dug at intervals varying from twenty-five (25) to fifty (50) feet apart; and in order that the plowing and laying down of the land may be effective, the ditches must be covered; and this has inaugurated the system of tile draining, at an expense of from twenty ($20) to forty ($40) dollars per acre, rendering land, previously of but little value, capable of the highest production.

9. This, however, can never be fully realized, unless the draining is followed by the deepest plowing, not only by the ordinary, but by the subsoil plow, and also by a system of high manuring, which shall supply not only nitrogenous manures, and those rich in the mineral food of plants, but

also those which abound in carbonaceous material, and will insure a perfect æration of the soil, and prevent its subsidence to its original compact and impermeable condition.

Care, however, should be taken that none of these several materials should be supplied in excess; and economy requires that neither should be added to soils enjoying it naturally in sufficient amount and in a soluble form.

10. The draining should only be undertaken after a careful survey by a competent person; the drains should be accurately delineated upon a map for future reference; the tiles should be laid on an uniform grade, so as to avoid sags in which silt might accumulate; the outlets should be as few as possible and carefully guarded, and, in some cases, with traps, to prevent their stoppage on the entrance of vermin.

11. As illustrative of the vast importance of this subject to the farming interests of the State of New York, it is believed that but a comparatively small portion of its arable land possesses a good natural drainage; a large proportion has this, but in an imperfect degree; and probably ——* per cent. has none at all, but demands a thorough application of the methods of the secondary system of drainage.

Insects—The Grain Aphis, Wheat Midge, &c.

Dr. Asa Fitch, Entomologist to the State Agricultural Society, opened the discussion by reading the following Essay on the grain aphis :

Mr. Chairman and Gentlemen :—I am requested to preface the discussion this evening by presenting to the audience some account of the grain aphis, an insect new to us in America, and which, during the past and the present year has been more prominent in the public regard than any other insect.

In the grain fields of Europe this grain aphis has existed from time immemorial. It was scientifically named and described eighty-one years ago, by the distinguished German entomologist, Fabricius, who met with it in fields of oats, and therefore named it the *aphis avenæ*, or the oat aphis, he being unaware that it occurred equally common upon other kinds of grain also.

But our European accounts of it are quite meager and imperfect. About all that we gather from them is, that it is an insect which shows itself upon the grain about the time of harvest, and that in some instances it has been known to be so multiplied, in particular places, as to literally swarm upon and cover the heads of the grain in many of the fields.

These few general facts, is all the information which the world has hitherto had of this insect. What becomes of it during the remainder of the year, where, and in what condition it lurks after harvest time, and until harvest time again approaches, had never been investigated. It was remaining for us in this country to trace out its abiding place and its habits during the autumn, winter and spring, and thus complete its history the year round, as we have been able to do within the past eighteen months, under the instructions of this Society, and under the auspices of the State of New York.

* This per centage was to have been supplied by Hon. T. C. Peters, of Genesee, from notes taken by him while engaged in the work of equalizing the assessments of landed property in the State, and will doubtless be furnished to the Society at an early day.

In this country this grain aphis had never been observed, and it was not known that we had such an insect here, until last year, when it suddenly appeared in excessive numbers over all the New England States, and the State of New York, except here in its western section, and also in the adjoining districts of Canada and of Pennsylvania. Throughout all this vast extent of country every grain field was invaded by it; many of these fields were thronged and a portion of them were literally covered and smothered by this insect.

This year it has moved westward, making its appearance in the same manner all over Western New York, Canada West, Northern Ohio, and at least, a portion of Michigan, as I judge from the numerous letters which have been sent me with grain heads containing this insect, and from the notices of it in the public prints, whilst at the East, where it was so numerous last year, it has measurably disappeared this year, so that, except in a few localities, it would not have been noticed had not everybody been so eagerly searching for it.

But though this insect has only been noticed in this country the past and the present years, we do not suppose it has newly arrived upon this Continent. It has no doubt been present in our grain fields heretofore, but in such limited numbers, and so scattered about upon the growing grain that it failed to be observed. It is seventeen years ago that I began to examine the wheat midge, and in looking at that and other insects upon the wheat, I recollect I have occasionly seen this aphis. But as only two or three individuals of this kind were to be found at a time, I supposed it to be of no importance, and thus gave no attention to it, until it began to appear in such abundance the past year.

Although it is a common habit of plant lice to become extremely numerous, at times, upon the particular kinds of vegetation which they respectively infest, we meet with no recorded instance in which one of these insects has been known to become so suddenly and excessively multiplied over such a vast extent of territory as has happened in our country with this grain aphis the past and present years.

I suppose almost every person in this audience has seen these insects, crowded together upon the heads of wheat, of oats, barley or rye, and has observed that they were a kind of plant louse, similar to what we frequently see upon the leaves of cabbages in our gardens, and on the apple, the cherry, and other trees. As it resembles these common and well known insects so closely in its form, its motions and habits, it will not be necessary for me to give any particular description of it.

With regard to the mode in which it injures the grain, I would observe that it has a slender, sharp pointed bill or trunk, which it holds under its breast when this implement is not in use. With this it punctures the leaves and stalks of the grain and sucks their juices.. It therefore has no occasion to leave the particular plant on which it is born, as it always has an ample store of nourishment directly under its feet. Hence it has no use for wings to carry it, like other insects, from place to place in search of food. It needs wings for only one purpose, namely, to enable it to emigrate to fields of grain which are unoccupied, in order to start colonies in them. Only a small portion of these insects, therefore, acquire wings;

and these fly away from the winter grain to plant their race upon the spring sowed wheat and oats.

The latter part of June, when the grain has advanced so that the heads or ears begin to put forth, two most remarkable changes occur in this insect, whereby it appears to become another creature, a different species, in the middle of summer from that which is seen in the spring and autumn.

One of these changes is in its habits. Before the heads appear it lives singly, scattered about upon the leaves and stalks of the grain, and the young lice, as fast as they are born, leave their parents and wander away. But no sooner are the heads protruded from their sheaths preparatory to blooming and growing the kernels of the grain, than this aphis wholly forsakes all the other parts of the plant and becomes congregated upon the heads, evidently because the juices which the plant elaborates for the growth of its flowers and seeds are much more nutritious, more dainty and palatable to these insects, than are the juices which circulate in the leaves and stalks. They here fix themselves upon the base of the chaffs which envelop the kernels, and inserting their beaks, they suck out the juices which should go, first, to grow the flowers, and after that to fill and perfect the kernels. And now the young lice which are born, instead of scattering themselves and traveling away, settle down closely around their parent, crowding as compactly together as they can stow themselves. Thus it comes to pass that when these insects are numerous, as we have recently had them, in many of our grain fields, scarcely an ear can be found which has not a cluster of these lice around the base of almost every kernel, all with their tiny bills inserted therein, pumping out the juices which should go to swell and perfect the seed. Thus, this grain aphis from being a solitary insect, wandering about singly upon the leaves and stalks, becomes a gregarious insect, clustered together in flocks, and remaining fixed and stationary upon the lower or but ends of the kernels.

At the same time another change, equally remarkable, takes place in the *color* of these insects. So long as they nourish themselves on the coarse juices of the stalks and leaves, their bodies are all of a grass-green color. But when they come to feed on the more delicate juices of the flowers, they begin to bear young of an orange color. One of the grass-green insects having stationed herself at the base of a kernel, the next day, in the group of little ones around her, a yellow one will occur, all the others being green like their parent. A day or two later, as the nourishment she derived from the leaves becomes more dissipated from her body and replaced by that now obtained from the kernels, half the young she produces will be of this yellow collor. And still later all the young are yellow, no green ones being any longer born. And the older ones after a time dying and disappearing, all these insects some weeks before harvest time, become changed to a yellow color, their hue inclining more to red in some and to yellow in others.

It is truly curious that this green insect, thus, on coming to feed on the juices which grow the flowers, begin to produce young of a gay yellow color similar to that of the flowers.

By depriving the kernels of a portion of the milky juice which should go

to swell and mature them, this insect causes the ripened grain to be more or less shrunken and light of weight.

Rye, however, grows so rapidly and ripens so early, that it outstrips this apis, in its increase, and thus sustains no material injury from it. Winter wheat, ripening more slowly, experiences more injury. But the crops which ripen latest, and when this apis has become multiplied to the greatest extent, namely, spring wheat and oats, become the most thronged and sustain the greatest injury.

Let us next inquire how it is that this insect is able to become so suddenly and so excessively multiplied as we have had it, in the eastern part of our State last year, and here in its western part this year.

I may observe that a hundred years ago it was a current opinion among men of science, that certain insects and other creatures pertaining to the lower orders of the animal kingdom were generated spontaneously. But, more recently, when these instances of supposed spontaneous generation came to be closely investigated, one after another of them were found not to be such. So that at this day the scientific world wholly discards the theory that there is or can be any such thing as spontaneous generation. All living things descend from parents; and it is by a pairing of the sexes that young are produced and that each species is continued in existence—some classes of animals bringing forth their young alive, others laying eggs from which their young hatch.

Insects are of this latter kind. They are all produced from eggs. But in the generation of the plant lice, we meet with one of the most remarkable anomalies which we anywhere find in the works of nature. These insects bring forth their young alive, at one time, and they lay eggs at another time. All the plant lice which we see upon our fruit trees during the spring and summer are females, and these do not produce eggs, but living young, which mature in a few days, and (wonderful to tell!) they are fertile without any intercourse of the sexes. It is only when cold weather and frosty nights arrive, that males are produced. The insects then pair, and the females thereupon lay eggs. These eggs remain through the winter, to be hatched by the warmth of the following spring. The young from these eggs grow up and commence bearing living young, no males and no eggs being produced, except as the closing act of their operations in autumn.

Such are the general facts with regard to the generation of the insects of this aphis group. And I had supposed it would be the same with this grain aphis. Some of you may have been present and heard the remarks which I made on this subject at our fair at Watertown a year ago. I stated that the eggs of this insect would probably be found late in autumn, scattered about upon the leaves of the fall sowed wheat and rye—which eggs would hatch with the warmth of the following spring, to start the insect upon the grain again this year. But when frosty nights arrived last autumn, and when the aphis on the apple trees was found paired, and the females were busy depositing their eggs, to my surprise, nothing of this kind occurred with this aphis upon the grain. The mature lice continued to produce young ones, until they and their young became congealed upon the leaves of the young grain by the advancing cold of the season. And

in this state they were buried beneath the snows of winter, and with the warmth of the ensuing spring they were thawed, and returned to life again.

To be better assured upon the subject, I placed some of these insects on grain growing in flower-pots and kept during the winter in a warm room. In this situation they continued alive and continued to bear young through the whole winter season.

Thus I have watched this grain aphis this year round, so closely, that I am perfectly assured no eggs were laid and no males were produced. Occasionally an individual was noticed, varying somewhat from the others, and which I have therefore suspected might be a male; but, on imprisoning such specimens in vials over night, I have invariably found young lice with them next morning.

When, and under what circumstances males occur, if they ever do occur, is yet remaining to be discovered. At present it seems as though these insects might go on forever, producing young, without any intercourse of the sexes.

Finally, with regard to the fecundity of these insects, I would state that those which have no wings, and which remain on the stalks of grain on which they are born, are much more prolific than those which have wings and wander abroad. By inclosing them separately in vials, I found the winged females quite uniformly gave birth to two young lice in a single night, whilst the wingless ones produced four in the same time. We frequently see young lice produced in the day time, but fewer appear to be born then than during the night. The winged ones are also much slower in coming to maturity. I placed several young lice the morning after they were born upon some grain growing in a flower-pot, and on the third morning afterwards I found four little ones around each of them, showing that the wingless ones come to maturity in three days. It will thus be seen with what prodigious rapidity these creatures multiply. They almost double their numbers daily. A single one producing four young daily, and these becoming equally prolific when they are three days old, her descendants in twenty days, if all live, will number upwards of two millions. This will serve to explain to us how it is that this insect becomes so excessively numerous upon the grain at harvest time, as we have seen it.

As they multiply so rapidly, it is evident no vegetation which they infest would escape destruction from these plant lice, if nature had not herself provided most efficient means for checking and subduing them. We accordingly find that these insects are preyed upon and consumed by other insects, to a greater extent than are any other kinds of injurious insects wherewith we are molested. There are whole groups and tribes of predaceous insects which subsist exclusively upon the plant lice of different kinds.

A tribe of very small Ichneumon flies, named Aphidius, are parasitic destroyers of these insects—puncturing and thrusting an egg into the body of the aphis, from which hatches a minute worm which feeds within the aphis till it kills it. I have found two species of these parasites destroying the grain aphis.

Another most efficient destroyer is the lady bug or coccinella, of which

there are numerous species, all of which are continually searching plant lice to feed upon, these being the sole nourishment of the lady bug, both in its larvæ and its perfect state.

In addition to these are the synphus flies, the golden-eyed flies, and the lace-wing flies, all mortal enemies to the different kinds of aphis.

By such means is it that these plant lice upon the grain as on other vegetation, are usually but a transitory evil—these, their foes and destroyers, always gathering around them wherever they become numerous, and multiplying until they overbalance and subdue them.

Some one asked for a description of the lady bug. Dr. Fitch described it as follows: It is about the size and shape of half of a small pea, of a yellowish red color, with round black spots upon it.

Question.—Is it poisonous to animals?

Dr. Fitch knew a single instance where swine had been pastured in a field where the lady bug was numerous. All of the herd were taken sick and some of them died. The swine were removed from that field to another, and such as were so removed recovered. Dr. F. said that it was possible that the swine were poisoned by eating large quantities of the lady bug; for if it is taken in the fingers and crushed, an acrid juice is emitted, which is doubtless poisonous, inasmuch as it is the insect's only means of defence. He had thought it possible that this particular herd of swine might have been poisoned by it.

Question.—Is there any prospect of the aphis becoming a permanent pest in the country?

Answer.—I think not. Its enemies are too numerous for that. Not more than a single year at a time, will they be likely to ravage in a single locality. As before said, they seem to be migrating westward.

Question.—Is the midge a permanent pest; is it plenty here at all seasons?

Answer.—There is no doubt that the midge is plenty in all parts of the country. The character of the season governs its ravages. If the latter part of June is wet, look out for the midge; if dry, there is no danger. In dry weather it cannot subsist on the uplands; it returns to the lowlands.

T. C. Peters—We are fast reaching the maximum of former years, in the amount of wheat sown in Western New York, and it is an important matter to us to know how to avoid the ravages of the midge. Do you recommend thorough culture?

Dr. Fitch—Strong growing wheat will produce despite the midge. Yes, I do recommend thorough culture as one of the preventives of the ravages of the midge; also of the Hessian fly and other insects.

Question.—What is the effect of the work of the aphis upon the grain, upon the kernel?

Answer.—The insect extracts the juices from the plant which aid in developing and maturing the kernel. This diminishes the size of the grain, sometimes virtually destroying it, for the substance is almost gone.

Mr. Geddes, of Onondaga, does not agree with Dr. Fitch concerning his theory with reference to the existence of the midge. He doubts if the midge exists in as great numbers one year as another, or if they are present at all, for prior to the past six years he had failed to get a crop of wheat

for some years on their account, while the past six years he had grown it successfully. His success, he thinks, is not due to dry Junes, but to the fact that the midge had disappeared. He doubts, too, if his success is due to superior culture, for he used to summer fallow all his land, now he turns it over and seeds after barley, and oats, etc., etc.

T. C. Peters.—So far as white wheat is concerned, the theory of the effect of the season upon the ravages of the midge upon it, is correct. But the Mediterranean is the only variety that can be grown now safely. He thinks the white wheat has very much degenerated.

Other gentlemen present coincided with him in this matter and united in asserting that the best mode of redeeming white wheat was to change the seed. It was further agreed that the Mediterranean had greatly improved by cultivation—that it was "bleaching out."

Mr. Bishop, of Wyoming, asked if early or late sowing had not had to do with checking the ravages of the aphis?

Dr. Fitch replied, yes. Its ravages are greatest on late sown wheat. Late sowing is not advised, if the object is to avoid its ravages. The same remark applies conversely to the midge. It does not so seriously affect the late as the early sown wheat.

President Cornell.—Have you observed the aphis in the ground around the roots of the barley?

Dr. F. had so discovered it.

Mr. Geddes—Why is it that the midge should have appeared one year, and not doubled the second and tripled the third, etc., etc.? He thought the midge was disappearing.

Dr. Fitch said there were two successive years when the midge disappeared, and then the third year appeared again and was very destructive. He does not think it was because the midge passed away from the country, but because the season was not favorable to its development, or at least not favorable to its operations on wheat; it passed to some other grain.

At this point there was a rambling conversational discussion upon the relative value of different varieties of wheat. Much of this the reporter was unable to hear. But he heard enough to establish the fact that there were many present who believed the Mediterranean the safest and best wheat to sow; that it was improving in character, while the white wheat of the Genesee Valley was deteriorating. A few claimed that better flour could be made from the Mediterranean than from any other wheat.

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out them England could not feed half her stock, or furnish her people with beef and mutton Their moist and cold climate is better suited to the root crop than ours, and justifies its more extensive culture; but I think we could profitably increase the culture of the Swede and mangold, and depend on them to a greater extent than we do for feeding our stock. The cooling nature of the mangold is well suited to counteract the heating tendencies of our Indian corn, and the two would go well together in fattening bullocks.

The live fences of England I think less of than I did before I saw them. The hedge generally occupies as much, or more, land as our crooked rail fence, and is quite as expensive. A stone wall is the best and cheapest farm fence, when the material is at hand to build it. England and America both have more fence than is profitable or desirable, in my opinion; the Continent perhaps has less. In traveling from Calais to Paris, thence to and through Switzerland, Germany, Prussia, and Belgium, we saw no fencing of farms, no hedge rows or waste land between crops. Cattle are easier fenced in than out, and the easiest method is pursued.

In England it is being discovered that they have more hedge rows than they can afford, and one estate that I have heard of has recently reclaimed and added 45 acres to its tillable lands, by uprooting old hedges and consolidating fields. It is high time for a fence reformation at home; but we should not be so radical as to destroy all our fences at once. E. C.

Borers in the Honey Locust.

LETTER FROM ASA FITCH, M. D., ENTOMOLOGIST OF THE SOCIETY.

Hon. B. P. Johnson: The letters which you forward me, with an accompanying box of insects, from Robert Howell, Esq., of Nichols, Tioga county, N.Y., dated January 27th, brings to our knowledge a fact not recorded before, that I am aware, namely, that the locust tree borer, *Clytus Robiniæ*, of Forster, (the same insect which was subsequently named *C. pictus* by Drury, and still later *C. flexuosus* by Fabricius,) which so greatly injures the locust trees all over our country, sometimes establishes itself also in the honey locust, *Gleditschia tricanthus*, in which it is thereupon apt to continue until it ruins the tree.

Mr. Howell says he set out two trees of the honey locust in his door-yard about twelve years ago. A few years after they were found to be badly infested by borers, which began to throw out their chips or worm dust from the trees each year about the tenth of June, the worms being then about three-fourths of an inch long, and of a dirty white color, with red heads. For a few years past the trees had become so much infested and eaten that numbers of their limbs died; and about the first of August last he cut them down. The larger tree was about six inches in diameter, and its body was completely cut to pieces by holes bored everywhere through it, and about a hundred in their pupa state—large, plump fellows, an inch long—were found in it. Some few weeks after, on splitting up the wood for fuel, other specimens were found, changed to their perfect state, but dead, and more or less decayed. One was obtained perfect, which he sends us. Some of its yellow bands are partly and others are

wholly obliterated, as they are liable to be in rubbed specimens of this beetle.

I may here remark, that my experience has been quite different from that of Mr. Howell. Two trees of the honey locust, which I planted in my yard twenty years ago, have been the most clean and free from insect vermin of any of the deciduous trees in my grounds. Though the borer is often present in the common locusts growing around them, it has never entered these trees.

I may add that I have from T. B. Ashton, of White Creek, a specimen of the locust tree borer, which he tells me was bred in the black walnut, *Juglans nigra*, in Pennsylvania, where it is not uncommon for the larvæ to occur in that tree.

The beautiful miller in the box is the *Clenucha Latreilliana* of Kirby—a very rare species—which I have met with only in a single instance, on the last day of June, the day before the date on which Mr. H. found this. No particulars of its habits are yet known. The other specimens in the box are common species, of which I have nothing to say, which is not already communicated to the public. Yours truly,

ASA FITCH.

Berkshire County, Mass., W. Bacon.

Hon. B. P. Johnson:

My Dear Sir: The present winter, though the contrast is great with that of several years past, we do not claim is without a parallel. We have up to this time had but little snow; a few inches fell in November, and gave an apology for sleighing for nearly a week. This went off and left the ground without frost. Early in December we had another fall, attended by a high wind, which rendered it unavailable, there being drifts and bare ground in about equal proportions. Then came on a warm turn, and the snow and frost alike disappeared. January has been very mild up to this date, and without sleighing. On the night of the 15th, and forenoon of 16th, we had a heavy fall of rain for any season, especially for winter. The streams were raised very high; the swamps appeared like lakes, and the highways were badly washed. The greatest degree of cold, so far, was 4° below 0, early in December. In January, up to date, the coldest morning was the 18th, mercury at 7°. With so mild and varying a temperature we have, of course, had much freezing and thawing, muddy and very rough traveling.

Many of our farmers are lamenting this absence of snow and the power of frost on the land, which events may to some extent be injurious; yet this change from former winters will work some valuable ends—at least the effect will be to destroy many of the insects which, for a few years past, have been increasing in so formidable a ratio. I well recollect that early in March, 1861, during a few days of mild weather, grasshoppers began to make their appearance. A cold turn followed, and I do not recollect a year within my memory when so few grasshoppers were seen in summer. The warm weather alluded to probably brought them forward, so that the frost gave the finishing blow. Now we have days so warm in

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ADDRESS

DELIVERED BEFORE THE ANNUAL MEETING OF THE STATE AGRICULTURAL SOCIETY, ALBANY, FEBRUARY 8TH, 1865.

BY ASA FITCH, M. D., ENTOMOLOGIST OF THE SOCIETY.

The insect which the past season attracted the most notice and did the most damage in our State, was the Aphis or Plant-louse upon the hops. Although the hop has been growing, both wild and cultivated, in this country, from time immemorial, I am not aware that this enemy has ever attacked or been observed upon it, until two summers ago, when it suddenly made its appearance in excessive numbers; and in consequence of its advent, the two past years have been the most disastrous to the extensive hop growers in the central section of our State, which they have ever experienced. In some yards the hops have not been picked, and in other yards a portion of those that have been gathered, it is said, ought never to have been dried and put up for market, they are so small and worthless; whilst the best that have been grown are of an inferior quality, the bitter principle, on which their value depends, being deficient, according to the published reports, to the extent of from 15 to 25 per cent.

The newspapers and agricultural periodicals have abounded with notices of this failure of the hop crop. From the extended accounts which some of these publications have given, it would appear that there are three different maladies with which the hop vines have recently become affected, namely, the Aphis or plant-lice, the honey dew, and the black blight. The plant-lice are soft pale yellowish-green insects, not so large as the head of a pin, which remain stationary upon the under sides of the leaves, crowded together and wholly covering the surface. The honey dew appears on the upper surface of the leaves, as a shining, clear and transparent fluid, sticky, like honey smeared over the surface. The black blight also occurs on the upper sides of the leaves and resembles coal dust sifted upon and adhering firmly to them, or the leaves look as though they had been held in the smoke of a chimney until they had become blackened over with soot. This black blight is deemed to be a kind of fungus growing from the leaves, analogous to the rust and smut in grain, and it is stated that in some hop yards sulphur has been dusted over the leaves to kill or check its growth, but without having the slightest effect upon it.

Which of these maladies is the most pernicious, it would be difficult to judge from the published accounts, one writer seeming to regard the Aphis as the principal evil, whilst another wholly ignores this insect and dwells upon the black blight as being the cause of the failure of the crop. And it is not a little amusing to observe how very wise the reporters to some of the newspapers appear in giving an account of these diseases, and what a display of scientific lore they make, when their statements betray to us

the fact that they have not the first correct idea upon the subject on which they are writing.

The truth is, these three maladies, about one and another of which so much has been said, are all one thing—differing merely as cause and effect. If there were no lice on hops there would be no honey dew and no black blight. I am aware the hop growers will be much surprised at this statement, and will scarcely credit it, they have been so accustomed to regard these things as distinct from and in no wise connected with each other—deeming the honey dew to be a fluid which has exuded from the leaves in consequence of some disease therein, and the black blight to be, as already stated, a kind of fungus growing from the leaves, whilst the plant lice, occurring only on the opposite or under side of the leaves, appear to be wholly separated from these substances upon their upper surface. But I am perfectly assured of the correctness of what I say, and can produce specimens which will demonstrate that I am correct. I regret that this subject did not occur to my mind last summer, or I would have had such specimens for exhibition here at this time. Upon the first opportunity, I will procure and place in the Museum of our Society, specimen of leaves showing this honey dew upon them, and others showing the black blight; and by the side of these leaves I will place white paste-board cards having the same honey dew and the same black blight upon them—thus demonstrating that these substances do not exude and grow from the leaves unless they also exude and grow from the paste-board cards.

I will now briefly explain how these two substances come upon the leaves.

Each Aphis has two little horns projecting from the hind part of its back, which horns are termed the honey tubes. From these tubes the fluid called honey dew is ejected, in the form of minute drops, like particles of dew, which, falling upon the leaves beneath them, the upper surface of the leaves becomes coated over with this fluid, more or less copiously as the Aphides producing it are more or less numerous. And now, this deposit of honey dew being exposed to the action of the atmosphere and alternately moistened by the dews at night and dried by the sun by day, is gradually decomposed, changing from a clear, shining, transparent fluid, to an opake, black substance resembling soot, and it is then the black blight. In this simple manner do we account for and explain these phenomena—these three important diseases of the hop, about which so much has been said and such erudition has been displayed by some of the writers in our newspapers.

These same phenomena, called honey dew and black blight, are not peculiar to the hop, but occur on other kinds of vegetation when infested by plant-lice; and an abundance of authority will substantiate my statement that this honey dew is caused by these insects. But I find no allusion to the black blight in any author, and what I state of that is the result of my own observations. It is proper, therefore, that I here adduce some of the evidence which I have, upon this particular point.

It is over twenty years ago that I first noticed this blackness as being occasioned by plant-lice. Among several willow trees by the side of a stream near my residence, there was one so thronged with the willow aphis that I went several times to that tree to contemplate the spectacle which

these insects presented. And all through the following winter, no person passing within sight of that tree could fail of noticing the blackness of its trunk and limbs, it being the more remarkable as none of the other willow trees around it had any tinge of this color. The thought thereupon became impressed upon my mind, that it was the plant-lice with which this tree had been so overrun the preceding summer, which had in some way imparted this blackness to its bark. Two or three winters afterwards, I noticed the same blackened appearance to a pine tree, which tree I knew had been thronged with Aphides the summer before. I need not specify the several other instances of this phenomena which I have noticed. Several years since, when I was investigating the Aphis of the apple tree, I discovered that, in addition to the bark of trees, the leaves also acquired this sooty appearance, from these insects; and then, upon giving this subject a particular examination, I became assured that this black substance was merely the honey dew in a decomposed state.

Some writers have remarked that dry weather causes the several kinds of plant-lice to increase and become pests to the different species of vegetation which they respectively inhabit; and my own observations incline me to regard this remark as being correct. During the dry period in June which frequently succeeds the spring rains, I have in particular years noticed these insects as occurring in unusual numbers, whereupon I have apprehended that, having acquired such a start so early in the season, they would prove to be the most pernicious insects of the year; but rainy weather coming on after this, they have seemed thereupon to decline and have ceased to attract further attention. Hence I think it true as a general rule, that dry weather favors and wet weather retards their increase. And at first thought, this view is further strengthened by the fact that this Aphis upon the hops was so excessively numerous the past summer, when we experienced a drouth of such protracted length and severity. But, on the other hand, these insects were similarly numerous the year before, when the summer was unusually wet. We are thus assured there is some influence more potent than the hygrometric state of the atmosphere, which has brought them forth in such hosts upon the hops.

Perhaps in no other group or family of insects are the different species so very closely akin to each other as in this of the Aphides. So nearly identical are most of them, both in their appearance and habits, that we know them to be distinct species only from the fact that they inhabit different plants, each one being unable to sustain itself upon any other than the plant to which it belongs. Being thus intimately related, we should confidently expect that the same atmospherical or other influence which causes one species to suddenly multiply and become extremely numerous, would operate upon and similarly affect the other species also. But this is by no means the case. As every one will remember, in the summer of 1861, all our fields of grain suddenly became so thronged with the Grain Aphis as to throw the whole country into alarm. Why did not the same cause which brought that insect upon us in such a remarkable manner, operate also to bring this insect upon the hops at that time, instead of two years later? Or, if this insect was not then in our country, when it did appear in such vast numbers two years ago, why was not the same influ-

ence which occasioned its surprising multiplication then, felt also by the Grain Aphis, causing it to re-appear in our grain fields? The two insects being so intimately related, it is a mystery beyond the reach of human comprehension, how some hidden influence comes to operate upon the one, causing it to multiply and increase so astonishingly, whilst the other remains passive and not in the least affected by it.

This insect is not limited to the extensive hop plantations in the central parts of this State, but appears to have everywhere overrun the hop vines, both wild and cultivated. It was abundant the past summer in my own neighborhood, and specimens were also sent me from St. Lawrence county, whereby we know that its range extends to the eastern and northern confines of the State, but farther than this we do not possess any definite information.

This Aphis appears to be identical with that which has long been known in Europe as the worst enemy of the hop, and which sixty-five years ago received its scientific name, *Aphis Humuli* or the Hop Aphis, from the German naturalist Schrank (Fauna Boica, vol. ii, p. 110.) Messrs. Kirby and Spence, in their introduction to Entomology (American edition, p. 135,) speak of the damage inflicted by this insect as follows: "Upon the presence or absence of Aphides, the crop of every year depends; so that the hop-grower is wholly at the mercy of these insects. They are the barometer that indicates the rise and fall of his wealth, as of a very important branch of the revenue, the difference in the amount of the duty on hops being often as much as £200,000 per annum, more or less, in proportion as this fly prevails or the contrary." This statement forcibly shows what a direct interest our own government has in patronizing these investigations in which I am employed—this one little insect, in years when it is numerous, taking from the revenue of the British government half a million of dollars!

My own researches upon this insect are obviously too limited as yet, to enable me to give such a particular history of its habits and operations, as its importance merits. I therefore present the following account from the London Gardener's Chronicle, for the year 1854, page 429:

"As soon as the Aphides settle upon the hops, they suck the underside of the leaves, and immediately deposit their young, which are viviparous, and have the singular faculty of propagating their species within a few hours after their birth; and in this manner many generations are produced without the intervention of the fully formed Aphis fly; indeed, upon one hill of hops, millions of lice are born and die, neither parents nor progeny having ever attained the condition of the perfect insect. When the first attack of these flies upon the hops is severe, and early in the season, the growth of the plant is commonly stopped in the course of three or four weeks. If the attack be late, that is about mid-summer or afterwards, the vine has then attained so much strength that it struggles on against the blight, to its disadvantage, and the result is a total failure of the crop at least; for the leaves fall off, and the fruit branches being already formed, there is no chance of recovery. At this time, and in this condition, the stench from the hop plantation is most offensive. * * * *

"The progress and usual termination of the Aphis blight may be thus

described: The flies, as before remarked, on their first arrival, immediately suck the underside of the upper small leaves of the vine, and thus they there deposit their young, upon the most succulent part of the plant. The multiplication of the lice is so rapid, that the leaves become so thickly covered as scarcely to allow a pin to be thrust between them. They quickly abstract the juices of the vine, so that the leaves assume a sickly, brown hue, and curl up, and the vine itself ceases to grow, and falls from the pole, the lice continuing till they perish for want of food; and thus the crop is destroyed, and the grower may often consider himself fortunate if the plant recovers a due amount of vitality to produce a crop in the following year, for occasionally the hills are killed by the severity of the attack. This description, of course, applies only to the most severe and unusual blights."

The Aphides are the most evanescent of all insects. They spring up suddenly, in such immense numbers as to threaten the utter destruction of the vegetation on which they subsist, and ere long they vanish with equal suddenness—sometimes continuing but a few weeks, and rarely remaining in force longer than through one year. It thus appears, that, so long as the atmospherical or other influence which favors their increase, continues to operate upon them, they thrive and prosper, and when this influence passes away they rapidly decline. The writer in the Gardener's Chronicle, cited above, remarks of this Aphis on the hops, "These insects are remarkably susceptible of atmospherical and electrical changes, and on a sudden alteration of the weather we have known them perish by myriads in a night. This was specially exemplified in the Farnham district, about the middle of June, 1846, which suddenly recovered from a most severe attack, and afterwards produced the largest crop ever known in that quarter. We know, also, several instances in East Kent, which occurred in the same year, when the planters sold their growths on the poles at a few shillings per acre, and these same plantations so far recovered that many of them afterwards produced a crop worth from 30*l.* to 50*l.* per acre."

The decline and disappearance of these plant lice is greatly expedited by other insects which destroy them; and in many instances it is to these destroyers rather than to any atmospherical change, that the vegetation on which they abound becomes so suddenly released from them. No other tribe of insects has so many enemies of its own class as the plant lice. The different species of Coccinella or lady-bugs which are everywhere so common, live exclusively upon the aphides, as do also the larvæ of the two-winged Syrphus flies and the four-winged Golden-eyed flies. Superadded to these destroyers the plant lice also have their internal parasites—exceedingly minute worms or maggots residing within their bodies and feeding upon till they kill them. Thus, whenever a tree or shrub becomes thronged with plant lice, these destroyers gather among and around them, in rapidly augmenting numbers, and subsist upon them until they have wholly exterminated them. Kirby and Spence (page 187) state that in the year 1807 the sea shore at Brighton and all the watering places on the south coast of England, was literally covered with lady bugs, to the great surprise, and even alarm, of the inhabitants, who were ignorant that their little visitors were emigrants from the neighboring hop-grounds, where each had slain his thousands and tens of thousands of the aphis.

These several kinds of destroyers of the plant lice were everywhere common upon the hop vines the past summer. I believe that in every instance in which leaves with the lice upon them were sent me by correspondents, I found one or more of these destroyers also upon the leaves; and in one box that came to me, not one of the lice was remaining, all having been devoured by several of these enemies which had happened to be inclosed in the box. These destroyers having been so common, it is quite probable that they have now subdued these lice to such an extent that the coming season the crop will be much less if at all damaged by them.

It is of great importance that we should have some remedy, whereby, when these insects do fall upon the hop vines in such myriads as they have done the past two years, we may be able to promptly destroy them.

As the lice remain stationary upon the undersides of the leaves and are so very tender and delicate that the slightest pressure suffices to crush and kill them, Mr. Kirby recommends to take the leaf between the thumb and finger, and move the finger so as to gently rub over the under surface of the leaf, whereby every aphis upon it will be destroyed. He thinks women and children can be employed for a small compensation to do this work, taking every leaf in succession between the thumb and finger, and thus wholly ridding the vines from these vermin. But we all know it will be an immense labor to thus take hold of every leaf upon the vines occupying whole acres of ground. Many of the leaves, too, are quite large, being five or six inches broad, and the finger is but three inches long. It will therefore require one hand to hold the leaf steady, whilst the thumb and finger of the other are drawn several times along it, mowing down the vermin by successive swaths. Moreover, the veins on the underside of these large leaves are studded with prickles, whereby I doubt if a dozen leaves can thus be rubbed over before the skin of the finger will be cut through to the quick. I need not specify other obstacles which occur to my mind, all concurring to convince me that this proposed remedy, of the success of which Mr. Kirby is quite sanguine, is wholly impracticable.

Washing and syringing the plants with strong soap suds has been often recommended for destroying the aphis upon them. I have recently been experimenting with this remedy, upon the plant lice which so badly infest the beautiful verbenas of our Flower Gardens, and I find it to be of but partial efficacy. It only kills the young, tender lice; those which are mature are so robust that they are not destroyed, even though the infested stems and leaves are immersed in a strong solution of soap.

There is one remedy, and one only, which we know to be efficacious and perfectly sure for destroying the different species of plant lice. This is the smoke of tobacco. It operates like a charm. It never fails. But to apply it, it is necessary to place a box or barrel over the plant, burning the tobacco in a cup underneath, until its smoke has filled the inclosed space and penetrated all the interstices between the leaves. Hereby the rose bushes and other shrubs and plants in our gardens are with ease wholly cleansed from these vermin. To render it available for destroying these insects upon the hops, probably a piece of canvas or other large cloth can be thrown over them or some other apparatus devised whereby they can be fumigated for a few moments in the same thorough manner.

his own experience, in which he had gradually extended his cultivation till he abandoned agriculture. It was more profitable than grain when he commenced raising it at five cents per pound. Mr. M. stated that highly manured tobacco grounds were usually too strong for grain to follow as a rotative crop.

Mr. Hawley, of Onondaga, mentioned instances where a rotation of crops was practiced with success. He understood that it was conceded that one ton of tobacco consumed about four hundred pounds of potash, but he had practiced rotation with success, raising forty bushels of wheat to the acre after tobacco.

Mr. Harris, of the Genesee Farmer, considered that though a farm contiguous to a town where plenty of manure was available, might be profitably devoted to tobacco, yet it would not do to rely upon home manure in its cultivation. He asked Mr. Geddes to state his opinion.

Mr. Geddes explained that he considered if a man devoted a portion of his land to tobacco, he would raise more stock, and thus enrich his soil, provided he did not raise too much tobacco.

Mr. Moses believed that in time the science of manuring would be reduced to such a system that it would not be necessary to over-manure land for tobacco, which is now apparently necessary.

Mr. Robinson wished to impress in the minds of farmers that a small crop of tobacco would benefit a farm and remunerate its owner well.

Mr. Hildreth, of Oneida, stated his *moral* views in relation to the raising of tobacco. He would not raise it more than he would raise the deadly Upas tree. He could not understand why agriculturalists should advocate the cultivation of this plant.

Mr. Robinson thought the gentleman ought not to raise corn or rye for distilling purposes.

Mr. Geddes considered that the discussion of the question morally was out of order.

Mr. Harris inquired if the tobacco raised in New York was not generally used for wrappers.

Mr. Moses said it was, and that a large portion of New York tobacco was imported. He stated the peculiarities and differences of Connecticut and Cuban soil, the latter being of remarkable depth and richness, and so requiring less manure than our own land.

1865

CORRESPONDENCE.

W. C. Watson writes us from

PORT KENT, *September 4th*, 1865.

Col. B. P. JOHNSON:

My Dear Sir—I have just been looking over your last volume, and am happy to notice that the high character of the series is, if possible, more than maintained. I read with the usual instruction and pleasure they afford the admirable paper of Dr. Fitch. I unfortunately have not the honor of a personal acquaintance with him, and, therefore, present to you one or two facts recalled to my mind by the views he advances and the results of his observation. I have for many seasons practiced on the theory of Dr. Fitch, in warring upon the cut-worm, etc. I am fully satisfied of the valuable effects of fall plowing, by disturbing and exposing their larvæ, eggs, etc. My course has been to plow for that purpose the very latest period possible before the permanent closing of the ground by frosts. Of late years I have adopted a plan which I think still more effective. I have noticed that almost invariably sands and other light soils open and are sufficiently freed from frost and moisture to admit plowing early in the spring, and that this term is followed by severe cold that entirely and rigorously freezes the earth. I have conjectured and acted on the idea that this period affords the most certain occasion by plowing to destroy worms and insects lying in the soil. Of course the system cannot be pursued on damp and heavy lands.

A year or two ago I observed an assault upon a monster cut-worm, which may prove that he has other enemies than those enumerated by the doctor. The rencontre might have been a "chance medley," rather than an attack in regular and legitimate warfare. As it occurred in the daylight upon the surface, I thought perhaps that the worm had been pursued into his hiding place and driven out by his enemy. I first noticed the worm making great progress, and in evident alarm, pursued by a black ant, which, at every opportunity, would fasten upon the worm with its jaws; he would then quicken his pace and shake the ant off, sometimes thrusting him away with his nose. This contest continued some minutes, and I thought the worm must effect his escape, when the attention of three or four other ants, which were at some distance, were attracted to the scene; they appeared at once inflamed by the greatest fury and excitement, and rushed upon the worm, fixing their fangs into different parts of his body. His agony and alarm were terrific; he writhed in his pain; his body was perfectly contorted in his convulsions, rolling over and over in his paroxysms, and even raising to his full length and throwing himself backward as if in the hope of crushing his enemies. I never witnessed such a spectacle of apparent suffering in an animal, and without waiting the result of *l'outrance*, I, in mercy, killed the worm. I afterwards observed that the body had disappeared; I had forgotten the incident until its memory was revived by the article of

Dr. Fitch. Are the little red ants injurious to vegetation? My ladies confidently assert that they are destructive to their flowers, and I have thought that I could trace evidences of their depredations upon my tender young plants.

Ants Enemies to Cut-Worms.

September 17th, 1865.

It had not occurred to me till brought to my mind by this letter of Mr. Watson, that ants will undoubtedly sometimes attack and persistently cling to and teaze the life out of cut-worms. In our cornfields, the earth immediately around the young corn plants is frequently perforated with holes leading to the underground dwellings of colonies of ants. And, though I have never actually observed it, I am confident it must occasionally happen that a cut-worm, in sinking himself under the surface to repose during the hours of daylight, will come into proximity with a nest of these pugnacious little creatures, who, resenting the intrusion, will make his bed anything but comfortable to him—giving him a similar experience to that of a lodger in the bedroom of a slovenly-kept inn. And at length finding it impossible to repose there, the worm will come out from his lurking place, in open daylight, with some of his incensed tormentors following and clinging to him in the manner witnessed and so vividly narrated by Mr. Watson. But as ants continue actively at work during the night as during the daytime, the cut-worm will usually discover those cornhills where ants have established themselves and will probably avoid intruding on them.

Mr. Watson inquires if the little red ant is injurious to vegetation. I presume it is what I have termed the little yellow ant (*Myrmica molesta*, Say) to which he refers. Like other ants of larger size, this is usually attracted to flowers and tender young plants, to sip some sweet fluid which it finds there, exuding from the vegetation, or secreted by plant-lice, where these are present. And it is frequently injurious, by wounding the plants to obtain a flow of sweet sap from them. This is particularly the case in young corn, the blades of which, when but a few inches high, are some years very much gnawed and stunted in their growth by this little yellow ant.

A. FITCH.

Wm. Bacon, Esq., writes us from

Richmond, Mass., *Sept.* 1, 1865.

Hon. B. P. Johnson:

My Dear Sir—The season is now so far advanced that a report of crops can be made with tolerable accuracy. Many pieces of meadow land were so thoroughly burnt over by the drouth of '64 that they gave very lean crops. Yet, on the whole, the grass crop is flattering—full a third more than last year. Oats were fine; so was barley. Rye has not in twenty-five years given a better crop. Corn was much disturbed by worms after planting, in consequence of which the re-planted is late; the growth and earing, however, are good, and the probability now is that it will all ripen and make a fine crop. Potatoes look nobly; it is too dry for the rot in any locality fit to raise potatoes. They will probably be somewhat injured by

The Thousand-Legged Worm.

MESSRS. LUTHER TUCKER & SON—Enclosed please find a sample of a small worm that has taken possession of my garden for the last three years, almost totally destroying everything of vegetable kind. In the winter season they disappear or go deep in the ground, and early in the spring commence on the winter roots, &c., and devour them until the young vegetables commence to grow, when they attack them and completely destroy all but some of the most hardy, which seldom get to perfection. The large strawberry, when near ripe, will often contain as much as fifty of them. They will make a small hole to enter, and devour the heart from the fruit, and so long as there is room for a worm they will go in. The young cucumber, radish, beans, onions, &c, all fall a prey to them. I call them wire worm, but not knowing them, I am uncertain whether correct or not; and as there are no others in the vicinity, I would like to know what they are, or if anything can be got to destroy them. I have tried lime, ashes, &c., but without success. The only way I can find to destroy them is, when the weather is warm, lay boards round the walks in the evening, when early in the morning they will be under the boards by *thousands* —then I apply boiling water.

Please say in THE CULTIVATOR, if there is any known name for them, and anything that will destroy them. JAMES ADAMS. *Armstrong Co., Pa.*

Answer to the above by Dr. Fitch.

MESSRS. TUCKER & SON—The worms from Mr. ADAMS, are a centipede or "thousand-legged worm," pertaining to the genus *Julus*, in the *Apterous* or wingless order of insects. Unlike the great mass of insects, these undergo no transformations, but always remain in the worm-like shape in which they hatch from the eggs. And whether these specimens are the young of one of our larger species, or a minute species now in its mature state, I am unable to say, having never yet carefully investigated the group.

One of the latest and best authorities respecting them says, "*ces sont des animaux inoffensifs*"—these are harmless animals. They are most fond of dark, damp situations; hence Mr. Adams finds them congregated under boards lying on the ground. Scarcely a bucket of water has been drawn from my well, this present season, that did not have one or two of these worms in it. Crawling from their retreats in the crevices of the stones of the well, they lose their foothold and drop into the water, the coldness of which renders them torpid and unable to crawl out. I must procure a trout and place it in my well to keep the water cleansed of these worms. Though should one of them chance to be swallowed in drinking, I doubt not the gastric juice would destroy and digest it. This, however, is an experiment in dietetics which I do not care about trying.

As to the food of these worms, it is no doubt vegetable substances which are in a diseased and decaying state. It is in old rotten logs in the woods that we always meet with our largest species named *Julus americanus* by Beauvois, and *marginatus* by Say, which is three and a half inches long, and over a quarter of an inch thick, of a lurid, grayish, olive color, with a red ring to each segment of its body, and usually just one hundred pairs of feet. And these small centipedes in our gardens and yards appear to be most numerous where decaying vegetable substances abound. Where a radish has been bored by the larva of the radish fly, where a cabbage root is clumpy or otherwise diseased, I have noticed these worms crowded together upon the affected spot, evidently to feed on the particles of semi-putrid matter they there find, and very probably promoting and extending the disease by removing this decaying matter, and thus exposing a fresh surface to the action of the atmosphere. And I presume the strawberries, cucumbers, &c., mentioned by Mr. Adams, were in the first instance wounded by ants or other insects, and were thereby rendered attractive to these centipedes. Several years since, a physician of this town, now deceased, from finding these worms very numerous in decaying potatoes, and unaware that they occurred abundantly on all other decaying roots, at once jumped to the conclusion that they were the veritable cause of the potato disease, and in the excitement at that time prevailing, his communications to the press on this subject attracted a somewhat wide notice. But everything known of these worms, impresses me with the belief that they never attack living, healthy vegetation, and consequently do not cause disease, though they may aggravate and extend it where it is already commenced. ASA FITCH. *Salem, N. Y.*

ely rain enough to lay the dust for a
are nearly as low as they were in the
dried up, and the prospect for a mid-

Utica. Our friend Hon. W. J. Bacon
l if my own and family's health per-
trying to get some of the Lebanon
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f our county papers in behalf of the
of our county people to come out. We
ire) between the middle of September
obably keep many away.

CATTLE PROHIBITED.

the act just passed by Congress to

a diseases among the cattle of the United

ouse of Representatives of the United
bled:
nd hereby is prohibited. And it shall
Treasury to make such regulations as
effect, and to send copies of them to
d to all officers or agents of the United

ed, that when the President shall give
hat no further danger is to be appre-
ectious or contagious diseases among
nd cattle may be imported in the same

es December 11, 1865.
EDWARD McPHERSON, *Clerk.*

ABLE TO LICENSE DUTY, AND ALSO ON ON GROSS RECEIPTS.

ENT, OFFICE OF INTERNAL REVENUE,
WASHINGTON, *Sept.* 29, 1865.

. I have to say that, as agricultural
to the managers or others, but rather
ural interests of the country, they are

JUL 87